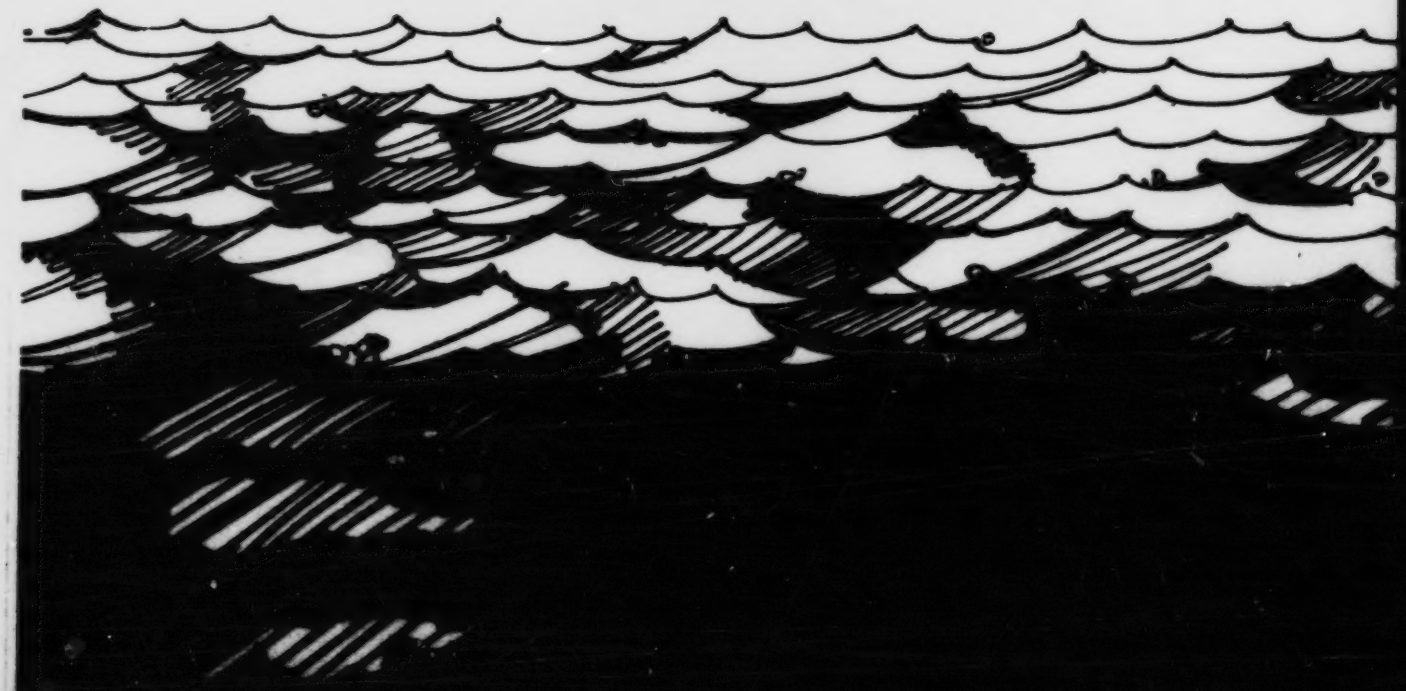
LAKE WABAMUN FINAL REPORT 1983



Lake Wabamun Watershed

Lake Wabamun Watershed
Advisory Committee

REPORT - June, 1983

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EXECUTIVE SUMMARY

The Lake Wabamun Watershed Advisory Council was established by the Honourable J.W. (Jack) Cookson on November 12, 1980. The committee membership consisted of fifteen representatives from various government agencies, local municipalities and several local interest groups. This committee successfully addressed the established terms of reference for the study by identifying existing and potential problem areas, informing and assisting relevant groups in the identification of potential solutions and formulating these into recommended management practices for the lake's future.

These objectives were accomplished through a series of twenty-three committee meetings which encompassed numerous lake tours and public involvement sessions. The result of such investigation was that the committee was able to identify and rank in order of concern the most prevalent lake management issues. These issues, ranked according to their importance, were weed growth, water quality, lake levels, land use practices and planning, recreation, fish and wildlife, and other future issues such as acid rain and air quality. The first four of these issues were identified as being of the most concern.

The committee had a total of sixteen presentations made to it from relevant personnel which covered all pertinent aspects of the lake management issue. These presentations covered such topics as possible solutions to the issues mentioned above and how these solutions might affect the lake in the long term.

The assessment of the background information, current issues facing the lake and possible solutions to these issues enabled the committee to formulate a set of ranked recommendations as to what future courses of action should be undertaken. These recommendations may be summarized as follows:

1. An expanded weed harvesting program need be established on a user pay basis.

2. A lake management plan covering both water and land use should be prepared and implemented.

3. The lake level study currently undertaken by Alberta Environment should be completed.

4. The control of the weed problem by the use of the white amur should be researched further.

5. A public information and education program on Alberta lakes should be implemented.

6. The use of herbicides to control the weed problem should be researched further.

7. The Minister of Environment should refer committee recommendations on septic systems, sewage disposal and lake bottom treatments to the proper authorities.

The background information leading to the Committee's recommendations, along with other pertinent data, is contained within a series of seven Appendicies to this report.

In summary, upon examining the issues and solutions, the committee's two strongest recommendations are that a weed harvesting program be implemented and that a full lake management plan be prepared and implemented.

1. THE COMMITTEE

1.1 INTRODUCTION

The Lake Wabamun Watershed Advisory Committee (LWWAC) was established by the Honorable J.W. (Jack) Cookson, Minister of the Environment, on 12th November 1980. The establishment of the committee was the result of a number of meetings held in 1979 and 1980 between representatives of the Lake Wabamun Preservation Association and ministers and staff representing Alberta Environment, Alberta Parks and Recreation, and Fish and Wildlife Division of Alberta Energy & Natural Resources, and the County of Parkland.

The subsequent appointment of the ministerial advisory committee was undertaken as a vehicle to bring together interested groups and government agencies to look at the problem of weed growth in the lake. The committee was advisory in nature and met to discuss problems associated with the lake, to review documentation, to suggest short term studies, and to make recommendations as to future management practices directed towards a maintenance or improvement in the quality of the lake. The Committee's original mandate to March 31, 1982 was extended by the Minister to December 31, 1983.

1.2 TERMS OF REFERENCE

The terms of reference for the committee are as follows:

1.2.1 Further the understanding of current knowledge about the Lake Wabamun watershed, existing multiple use practices and issues related to problems associated with such multiple use.

1.2.2 Review studies undertaken by various public and private agencies (including discussions with participants), with such ancillary

information as may be forthcoming, interpreting them with respect to future watershed use practices.

1.2.3 Assist and advise the public participation staff at Alberta Environment in the delivery of an information program on watershed management, and in the identification of existing and future concerns of communities, local government groups and other agencies or organizations.

1.2.4 Assist the Lake Wabamun Technical Study Committee of Alberta Environment, and any other agency conducting watershed studies, when so requested, in the preparation of research and study proposals, review of such studies, and the developing of recommendations based on these studies.

1.2.5 Recommend such studies as may be considered important to the development of proper long term watershed management practices which will protect Lake Wabamun.

1.2.6 Prepare interim documents and a final report, to be submitted to the Ministers, which will include recommendations on future management practices for the Lake Wabamun watershed. The final report will be submitted to the Ministers on or before March 31, 1982*.

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* Subsequently extended to December 31, 1983.

1.3 MEMBERSHIP

Membership of the committee consisted of the following people:

Name of Member	Address	Occupation
Mr. W. Cowan-Smith (Alberta Summer Villages Association)	Edmonton	Executive Director Alberta Summer Villages Association
Mr. N. Giffen (Edmonton Regional Planning Commission)	Edmonton	Executive Director Edmonton Regional Planning Commission
Mr. R. Barber (Farming Community)	Fallis	Farmer
Mr. Miles House (Paul Indian Band)	Duffield	Chief, Paul Band
Mr. R.G. Hurlburt (Lake Wabamun Preservation Association)	Edmonton	President Universal Property Services Ltd.
Mr. G. Field, Q.C. (Lake Wabamun Preservation Association)	Edmonton	Associate Director Institute of Law Research and Reform University of Alberta
Mr. J. Hill, Q.C. (Lake Wabamun Preservation Association)	Edmonton	Lawyer Hill and Starkman
Dr. M.J. Paetz (Director of Fisheries Energy & Natural Resources)	Edmonton	Public Servant Director Energy & Natural Resources
Mr. P.E. Skydt (Associate Director Recreation and Parks)	Edmonton	Public Servant Associate Director Recreation & Parks
Mr. G. Mann (Councillor County of Parkland)	Fallis	Farmer County of Parkland Councillor
Dr. W.R. MacDonald (Director Research Management Alberta Environment)	Edmonton	Public Servant Director Environment

Mr. C.H. Weir (Chairperson)	Edmonton	Senior Partner Stewart, Weir, Stewart, Watson, Heinrichs & Dixon
Dr. J.B. Railton (Calgary Power Ltd./ TransAlta Utilities)	Calgary	Manager Environmental Planning Calgary Power Ltd.
Mr. W.S. Davies (Wabamun Home Owner's Association)	Edmonton	Public Servant Assistant Deputy Minister Government Services
Mr. D. Stadnick (Councillor Village of Wabamun)	Wabamun	Office Manager Manalta Coal Ltd.

During the life of the committee, a number of changes in membership occurred. Mr. G. Field was replaced by Mr. A. McTavish as representative from the Lake Wabamun Preservation Association and Dr. B. Hammond replaced Dr. W. MacDonald as the representative from Alberta Environment.

Membership in other groups by some committee members, e.g. John Hill in the Sunshine Bay Yacht Club, Al McTavish in the Edmonton Yacht Club and Bob Hurlburt in the Wabamun Sailing Club, increased the range of groups having direct access to the committee.

At the January 28th, 1981 meeting, committee members were requested to appoint alternate voting members should they be unable to attend meetings. The following individuals were subsequently appointed:

Member	Alternate
Mr. W. Gowan-Smith	Mr. D.F. Gowan-Smith
Mr. R. Barber	Dr. J.D. Ross
Mr. R.G. Hurlburt	Mrs. L.J. Hardy
Mr. A.D. McTavish	Mr. J.H. Forest
Mr. J. Hill	Mr. K.F. Bailey

Dr. J.B. Railton	Mr. F.A. Williamson
Dr. M.J. Paetz	Mr. K. Zelt
Mr. P.E. Skydt	Mr. L. Duchesne
Mr. W.S. Davies	Ms. S. Gerrie

1.4 CONSULTANTS

Alberta Environment assigned Ms. Helen Habgood to the committee and she was responsible to review technical reports and coordinate the committee's activities. Helen's resignation from government service on March 31, 1982 resulted in the appointment of Dr. Dale Allen of the University of Alberta Botany Department as consultant to the committee. Ms. P. Mitchell, who headed Alberta Environment's Lake Wabamun Eutrophication Study, also provided the committee with considerable input. The committee's public participation program was coordinated by Mr. B. Diepeveen of Alberta Environment's Community Affairs Branch. Mrs. L. Kuprys of Stewart, Weir & Co. provided secretarial services for the committee.

2. COMMITTEE ACTIVITIES

2.1 COMMITTEE MEETING SCHEDULE (Summary)

Since its appointment, the committee has met on 23 occasions (see Appendix 3) spending the first few meetings identifying and ranking concerns about the lake. Subsequent meetings were spent gathering technical information and being briefed by various experts. The committee's meeting schedule in late 1982 and early 1983 was reduced as members began to review the information received and to develop recommendations for the Minister. Two interim reports, dated December 1981 and September 1982 (Appendix 4), were prepared and presented to the Minister of Environment. Members also met with the Alberta Planning Board on October 21, 1982 to discuss the development of a comprehensive lake management plan for Lake Wabamun.

2.2 LAKE TOURS

In order to obtain a firsthand look at weed growth in the lake, as well as to view Alberta Environment's eutrophication study, two lake tours were organized. The first tour on August 24, 1981 involved a comprehensive boat tour of the lake to view the weed problem, high water damage, eutrophication study activities and thermal discharge. The second tour on August 19, 1982 had two components: first, a helicopter tour of Lake Wabamun and Lake Isle to view weed growth on both lakes; and second, a lake tour examining TransAlta's weed harvesting program and Alberta Environment's eutrophication study. The tours provided committee members with an opportunity to examine in detail the issues confronting lake users.

2.3 LITERATURE REVIEW

One of the committee's first tasks was the review of the literature relevant to Lake Wabamun. A large number of studies has been carried out in the past and the committee saw the need to provide a comprehensive overview of this

information. Helen Habgood, the committee's technical assistant, subsequently completed a detailed literature review which was printed in March 1983. This document was released by the committee and is now available to the public. Copies can be obtained by writing to Community Affairs, Alberta Environment, 9820 - 106 Street, Edmonton, T5K 2J6. Appendix I contains the executive summary and the final summation of the Literature Review.

2.4 PUBLIC INVOLVEMENT

From the onset, the committee was determined to provide an effective public involvement program. This program was carried out in the following manner:

2.4.1 Newsletters

A comprehensive mailing list (approximately 1,500 names) was compiled consisting of cottage owners as well as other interested lake users. A newsletter, "Wabamun Advisor", was developed and a total of nine issues (see Appendix 5) was mailed out to all on the mailing list. The committee intends to send out one final newsletter which will advise the public of the contents of the committee's final report.

2.4.2 Public Meetings

The committee sponsored two public meetings in the Village of Wabamun as well as a public demonstration of the activities involved in the lake eutrophication study. The public meetings were held on September 19, 1981 and August 28, 1982. The events were advertised in both the Edmonton Journal and the Stony Plain newspaper, notices were mailed out and posters put up around the lake. Approximately 60 people attended the first public meeting and 50 people attended the second meeting. The eutrophication demonstration was well received and, despite cold windy weather, approximatley 40 people attended.

2.4.3 Information Trailer

An information trailer was set up in the Village of Wabamun in the spring of 1980 to provide the public with an opportunity to obtain some firsthand information about the eutrophication study. The trailer was open to the public during the summers of 1980 and 1981 and was manned by Alberta Environment staff on holidays and weekends. Approximately 50 people stopped by during 1980 to discuss the study; however, it can be noted that it rained on at least half of the days that the trailer was open. In 1981, the number of visitors increased to 82 with the majority of questions centering around weed growth.

2.4.4 Presentation to Wabamun Sailing Club

During the 1981 sail week, the committee's chairman, Mr. C.H. Weir, and Ms. H. Habgood made a presentation to the Wabamun Sailing Club. The presentation, which dealt with the committee's work as well as the eutrophication study, was well received and evoked considerable discussion.

2.4.5 Display in the Summer Village of Seba Beach

For a week prior to our 1982 public meeting, a display outlining the mandate of the committee, its members, and its recommendations to date, was on display in the village. This display received a positive response and also served as a reminder that a public meeting was scheduled.

2.4.6 Questionnaire

Members of the public who attended the first public meeting were asked to respond to a list of concerns identified by the committee. The results of this questionnaire indicated that weed growth, water pollution and long term preservation of the lake were of prime

concern to those in attendance. This tended to confirm the committee's own perception of the issues.

As the committee began to discuss the concept of an expanded weed harvesting program, it was felt that it would be beneficial to obtain some public input into the discussion. As a result, a questionnaire was developed and distributed to three different groups. It was first mailed out in late November 1982 to all of those on the committee's mailing list and then, in early February, it was mailed out to all members of the Sunshine Bay Yacht Club, the Wabamun Sailing Club and the Edmonton Yacht Club, as well as to the local municipalities. The questionnaire was also handed out to interested people at the Edmonton Sportsman's Show. Results of the questionnaire can be found in the section dealing with weed harvesting.

2.4.7 Edmonton Sportsman's Show

For the period of March 9 through March 13, 1983, the committee was represented at the Sportsman's Show. A booth was rented and a display set up which not only provided people with the committee's terms of reference but also a list of the recommendations made to date. The booth was manned by representatives of the Advisory Committee as well as Alberta Environment's staff involved in the eutrophication study which pointed out that people were unaware that their own activities in attempting to improve their property contributed to weed growth. (See Appendix 2.) Well over 350 people stopped by the booth to discuss the study and the committee's work. Of those who stopped, 48 people filled out a brief questionnaire and 35 people requested that their names be placed on the mailing list.

2.4.8 Environment Week

In keeping with its commitment to public involvement, the committee

intends to take part in the upcoming Environment Week (June 5-11, 1983). The committee's display will be set up in Heritage Mall and committee members will be on hand to discuss the committee's work with the public.

2.4.9 Summary

At the onset of the committee's work, two goals were set for the public involvement program:

1) Information Dissemination

The committee's goal was to keep lake users and the general public informed of its work as well as communicating its findings to the public. The newsletter, information trailer and the extensive use of the display formed the nucleus of this component.

2) Information Acquisition

The committee's intention was to receive input from the public on two issues, identification of the critical problems facing lake users and public reaction to specific mitigation measures which the committee might propose. Public meetings, two questionnaires and involvement in the Sportsman's Show comprised this component.

The public involvement program, in providing a continuing dialogue between committee members and the public, has pointed to the need for public education. Two critical issues identified, weed growth and lake levels, formed the basis for most of the dialogue between the public and the committee. The questionnaire and discussions with lake users at the Sportsman's Show indicated that a significant portion of the general public continued to blame TransAlta for

excessive weeds in the lake. This attitude began to change as people began to understand how the nature of Lake Wabamun, and Alberta lakes in general, facilitates and encourages weed growth.

As the work of the committee proceeded, information on lake levels also pointed to the need for informing people about the impact of high levels on the entire lake. While high levels caused problems for people at the west end of the lake, this was not necessarily so for those on the east end and, in fact, some of those residents preferred to keep levels high. The need for further information became clearer as people began to realize that both the capacity of Wabamun Creek, as well as the type of control structure, affects the rate at which the lake level varies. To this end, the Wabamun Lake Level Study has included representatives of all the affected groups on the advisory committee as well as having the committee play a part in supervising the development of a water balance model.

2.4.10 Recommendation

The committee feels that an education program among all lake users would go a long way in correcting much of the misinformation which exists not only for Lake Wabamun, but for the majority of Alberta lakes. As such, the committee recommends that:

Alberta Environment, in conjunction with public representatives (i.e. the Alberta Association of Summer Villages), develop guidelines and an information program for cottage owners and lake users which not only focusses on the nature of Alberta lakes but on how the general public can assist in keeping lakes clean and healthy for future generations.

3. RESOURCE PERSONNEL AND PRESENTATIONS

In fulfilling its mandate, the Committee made a determined effort to avail itself of all the material available pertaining to the issues at hand. Not only was a wide variety of expertise brought in but information was received from British Columbia as well as from firms in Georgia and Wisconsin. The following is a list of the individuals who appeared before the Committee and the topics they discussed.

3.1 Drs. Dale Allen and Paul Gorham - Botany Department, University of Alberta

- origin of Alberta lakes
- sediments, water and nutrient systems
- management alternatives

3.2 Ms. Pat Mitchell, Water Quality Control Branch, Alberta Environment

- eutrophication study of Lake Wabamun
  Its three main objectives are:
  - to measure the nutrient inputs
  - to determine present quality of the lake
  - to identify what can be done to control the nutrient level

Ms. Pat Mitchell continued to make regular presentations to the Committee on the progress of her study.

3.3 Ms. Janice Crosby, Beak Consultants

- Reviewed Beak's work on behalf of TransAlta since 1973.
- Concentrated on Elodea, its appearance, spread and subsequent disappearance from 1968 through 1979.

3.4 Mr. Trefor Reynoldson, Pollution Control Division, Alberta Environment

- Discussed dredging of the whole lake and diversion of the North Saskatchewan River through Lake Wabamun.

3.5 Mr. Courtenay Breckenridge, County of Parkland Development Officer

- End Land Use Plan being undertaken by the County.

3.6 Mr. Wes Shennan, Edmonton Regional Planning Commission (ERPC)

- ERPC Lake Management Plan for Lake Wabamun.

3.7 Mr. Bob Rempel, Public Participation Branch, Alberta Environment

- Public involvement program for the committee.

3.8 Mr. Ken Zelt, Alberta Fish & Wildlife

- Fisheries in Lake Wabamun.

3.9 Mr. D. Schinkel and Mr. K. Andries, Provincial Parks Division, Alberta Recreation and Parks

- Presented a paper entitled "The Regional Significance of Wabamun Lake as a Recreational Resource".

3.10 Mr. D. Prosser, Groundwater Branch, Alberta Environment

- Groundwater and its relation to Lake Wabamun.

3.11 Mr. B. Purdy, TransAlta Utilities

- Current weed harvesting program of TransAlta Utilities.

3.12 Mr. G. Warwa, Omega Tree Specialists

- Made a presentation in regards to the "Root'r", a land-based weed harvester.

3.13 Mr. D. Pledger, Pesticides Chemicals Branch, Alberta Environment

- Use of herbicides in the lake.

3.14 Mr. A. Masuda, Head Water Quality Control Branch, Alberta Environment

- Sewage discharge problems and boats on Lake Wabamun.

3.15 Mr. Whitford, Plumbing Inspection Branch, Alberta Labor

- Septic fields and holding tanks.

3.16 Mr. G. Allen, Yellowhead Regional Planning Commission

- Lake Wabamun Lake Management Plan.

In addition to these individuals, the committee has been served by two technical resource people - Ms. Helen Habgood and Dr. Dale Allen. During the time that Ms. Habgood worked for the committee, she prepared technical discussion papers on a wide variety of issues. These included flushing, dilution and dredging of the lake, as well as lake bottom treatments and herbicide use. Dr. Allan provided supplemental material to some of the above and examined such issues as expanding the weed harvesting program and the introduction of a weed eating fish (white amur) to the lake.

During its tenure, the committee had access to a large amount of information from TransAlta Utilities and enjoyed a good working relationship with Dr. John Railton. In addition to obtaining technical studies, the committee received regular reports on the existing weed

harvesting program and also had an opportunity to examine how the harvesting system worked.

The Energy Resources Conservation Board's report on alternative cooling facilities also provided the committee with background material.

The availability of the above information enabled the committee to undertake a thorough review of the problems and to produce a series of well-researched recommendations.

4. ISSUES REVIEW

As previously indicated, the committee spent its first few meetings reviewing the issues surrounding the lake and establishing a list of priorities. Each of the committee members outlined the concerns expressed by his organization. These were then categorized and collated. At a subsequent meeting, a refinement took place and the issues were then ranked according to importance with the following results:

4.1 Weed Growth

- Nuisance weed and other aquatic growth
- Weed control measures (mechanical, chemical, biological)

4.2 Water Quality

- Nutrient enrichment and other pollution (domestic, industrial, agricultural)
- Determination of natural condition of the lake
- Thermal input

4.3 Lake Levels

4.4 Land Use Practices and Planning

- Coordination of planning, infrastructure and development (residential, recreational, industrial, agricultural)
- Lack of public awareness
- Mining operations and procedures

4.5 Recreation

- Insufficient public recreation facility areas

- Retention of recreation resource
- Boat regulation and regulation of other lake uses

4.6 Fish and Wildlife

- Management and protection of fishery (sport, commercial, Indian)
- Protection of wildlife habitat

4.7 Other (Future) Concerns

- Acid rain
- Alternate cooling facilities effects
- Ramifications of Lake Wabamun Watershed Advisory Committee's (LWWAC) actions for all Alberta recreational lakes
- Air quality
- Energy costs

The committee recognized that all of the concerns had a direct bearing on the lake but, given their mandate, concentrated their energy on the first four issues with emphasis on weed growth. Each of the issues were examined in detail and recommendations made. Community response at the September 1981 public meeting confirmed that the Committee's list of concerns was accurate. The 1982 public meeting emphasized the immediate problem of high water levels.

5. DEVELOPMENT OF RECOMMENDATIONS

5.1 WEED GROWTH

In reviewing possible solutions to the weed growth, the committee examined the following solutions:

5.1.1 DREDGING

5.1.1.1 Background Information

Studies carried out in the past indicate that the sediments in Lake Wabamun extend to a depth of 16 metres (65 ft.) in some places and date back 9,000 years. The concept of dredging is effective only if all the sediment is removed. Results of the 1975 dredging experiment in Lake Wabamun indicated that Elodea came in after the top 450 mm (18 in.) of sediment and the existing macrophytes had been removed.

Trefor Reynoldson, Pollution Control Division, Alberta Environment, indicated to the committee that dredging the whole lake would be totally impractical. The 1975 program covered an area of .78 hectares (1.92 acres) in a narrow strip just off of the Provincial Park beach. The cost of removing only 450 mm (18 in.) of sediment was $29,900/hectare ($12,100/acre).

In the Lake Wabamun Study 1973, Reid Crowther reported that "Dredging areas completely clear of weed growths has been carried out in other localities. It is a method more normally employed in navigable waters such as canals. It is not considered an acceptable method at Lake Wabamun due to possible damaging effects on the lake biota and the great depth of flocculent sediments which would have to be removed. A further disadvantage would be the

difficulty of disposing of the very large quantities of dredged material" (p.124).

5.1.1.2 Conclusions

The committee concluded that dredging of the whole lake is impractical and not a workable solution for water quality improvement.

5.1.2 HERBICIDE USE

5.1.2.1 Background Information

Herbicides, properly selected and applied, can effectively control aquatic macrophyte growth. Degradable organic herbicides that are relatively safe have been developed.

Professional expertise and in-situ testing are essential to determine the type and dosage of herbicide to be used. Even dispersal of herbicides under water is much more difficult to achieve than spray applications on land plants. Good application techniques can maximize the efficiency of the herbicide and minimize the drift of the chemical into adjacent areas. Herbicide treated water cannot be used for swimming, irrigation, animal or human consumption until herbicide levels are below "safe" limits for a specified number of days after treatment. Exposure of the public to the herbicide application is a major concern in recreational lakes.

Treatment is usually done around the edges of a lake where weeds are growing. Usually, one treatment per growing season is sufficient. Nuisance algal blooms may follow extensive macrophyte eradication as nutrients are released from the decaying plants;

dissolved oxygen may also be depleted by decomposition. Chara sp. may invade treated areas.

Effects of large-scale herbicide application on other lake biota are unknown. Reductions of zooplankton and zoobenthos could have drastic effects on fish populations.

5.1.2.1.1 Lake Wabamun Experiments

In May 1961, the herbicides acrolein and 2,4-D were tested in the east end of the lake and, at that time, herbicides were deemed to be inefficient and too costly to provide adequate control.

Experiments using the herbicides paraquat and diquat were conducted in Lake Wabamun in the early and mid-1970's by Gallup et al. (1973) and Beak (1980) respectively.

In 1972, Gallup et al., working with Dr. J. Allan (Canada Dept. of Agric., Lethbridge), treated a 1.21 hectare plot (3 acres) with a 0.5 ppm concentration of a 1:1 paraquat/diquat mixture and observed effects on biota. Zooplankton populations were reduced by 17% to 94%, depending on species, 12 hours after application. Laboratory tests indicated that herbicide caused debilitating behavioural effects on zooplankton. Zoobenthos populations were immediately reduced but completely recovered in size in two weeks by recolonization from outside the treated area. Epipelic algae were not adversely affected. Gallup et al. detected no harmful long term effects but cautioned that since only a small area was treated, full effects on the animal community could not be determined. Whitefish could be seriously affected should large-scale herbicide application reduce their food organisms.

In 1975, Beak monitored herbicide tests (done by Dr. Allan and TransAlta) using 1:1 paraquat/diquat on three 2.10 hectare plots

(5.2 acres). Short term responses appeared to be insignificant for zooplankton: for most species, numbers declined both inside and outside the curtained-off test plots in the first two days after treatment but, by five weeks had returned to normal. Benthic invertebrate density increased immediately following treatment both inside and outside the plot but later declined to normal. Beak concluded that herbicide application did not appear to have deleterious long term effects on zooplankton, zoobenthos or phytoplankton; however, had a larger area been treated, recolonization would have been slower. They recommended that application of 0.5 mg/L (0.521 ppm) provided sufficient macrophyte control. Chara shows considerable resistance to paraquat/diquat and rapidly invaded the areas treated in 1972 and 1975.

5.1.2.1.2 British Columbia Experience

Eurasian water milfoil (Myriophyllum spicatum) has become a major problem in recreational lakes in the Okanagan valley. Various control technologies have been used including the use of the herbicide 2,4-D. 2,4-D is effective in controlling milfoil while leaving other macrophytes unaffected. 2,4-D kills roots of the plant while paraquat and diquat affect only stems and leaves. However, the herbicide has not been applied to large blocks of weeds or to whole lakes; spot treatments have failed to eradicate milfoil. Human exposure to 2,4-D through recreation, domestic or agricultural water uses is a common concern. In most of the infested lakes in the Okanagan valley, milfoil is considered well established and beyond hope of eradication, and herbicide use in these lakes has been discontinued. In certain lakes where there is still hope of eradication, 2,4-D is still being used. In 1979, 2,4-D treatment of Wood and Kalamalka lakes cost $4300/ha ($1740/ac.) excluding some research costs but including costs of monitoring and providing alternate water supply systems (Newroth

1980). The use of herbicides in the highly used recreational Okanagan lakes has met with public opposition, mainly regarding human exposure and long term health effects (Warnock and Lewis 1978).

5.1.2.1.3 References

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5.1.2.2 Conclusions and Recommendations

1. Large-scale herbicide application should not be used for weed control in Lake Wabamun because of risk of exposure of public and unknown ecological effects.

2. The Department of Environment embark on a program to implement the use of herbicides on a very limited scale in localized areas and with careful monitoring for experimental purposes to determine their effectiveness as a deterrent to undesirable weed growth.

5.1.3 LAKE BOTTOM TREATMENTS

5.1.3.1 Background Information

5.1.3.1.1 Physical Liners

Sediments in the littoral zone may be covered with flexible plastic or polyethylene lining material, which is then covered with sand or gravel to hold it in place. The plastic is a barrier to diffusion of nutrients from the sediments. The material should be perforated to allow gases to escape from the sediments (Theis 1979; Dunst et al. 1974). This method has been used in lagoons and small reservoirs but its effectiveness for lake treatment is uncertain. Permanency of treatment and effects on benthic organisms are major unanswered questions (Theis 1979). Nichols (1974) estimated a cost of $679/ha ($275/ac) ($1324/ha or $536/ac 1981) for 4 mil. plastic sheeting. A 372 m^2 (4000 sq.ft.) roll of 4 mil. polyethylene costs $90 (Merlund Plastics, Edmonton); this equals $2422/ha (980/ac.).

5.1.3.1.2 Fiberglass Screen

A closely woven vinyl-coated fiberglass screening material (Tradename: Aquascreen) placed directly over rooted aquatic plants results in immediate decomposition of plants and retards regrowth. No adverse ecological impacts have been observed. Screens will probably need to be removed and cleaned annually, but can be left in place over the winter. Estimated cost including installation is $29,652/ha ($12,000/acre) (1980). Coverage of 92.9 m^2 (1000 sq.ft.) averaged over 5 years would cost $110-140 per year. Screens are expected to last at least 10 years (Mayer 1978; Perkins 1980).

5.1.3.1.3 Sand

Sand has been widely used on littoral sediments to control macrophytes and create beaches. Alone, it provides little barrier to nutrient diffusion but may consolidate flocculent sediments (Theis 1979). Sand or gravel may also be placed over a plastic sheet which prevents nutrient diffusion. The long term effectiveness is questionable and continued maintenance is required; therefore, this technique is recommended only for small areas (Nichols 1974). A sand and gravel blanket over plastic sheeting at Marion Millpond, Wisc. 43.8 ha (108.2 ac.) cost $494/ha ($200/ac.) in 1973 and $1059/ha (428/acre) in 1981, and effectively controlled macrophytes for only two seasons.

5.1.3.1.4 Clay

Clay lining has been used to retard seepage from reservoirs but it has not been tested as a lake treatment. It may be effective because it lengthens the diffusional path and absorbs nutrients, thus causing positive chemical changes. Getting a good settled layer on the bottom may be a problem, especially if the lake sediments have a low specific gravity. It may be necessary to draw the lake down and apply the clay before refilling (Theis 1979).

5.1.3.1.5 Flyash

Flyash has been used successfully to reduce sediment nutrient release. Flyash is very fine-grained and usually has a high lime and alumina content; thus, it would have both physical and chemical effects. A 2-5 cm (3/4-2 in.) layer of flyash applied to Lake Charles East, Ind. significantly reduced sediment phosphorus release. However, subsequent development of a detrital layer on top of the ash due to primary production

(algae) reduced the positive effects of the ash (Theis and McCabe 1978). Treatment with lime and flyash sealed sediments and lowered phosphorus concentrations in the water (Higgins et al. 1976). Supplemental lime treatments were suggested as more economical than additional flyash treatment (Higgins et al. 1976).

Further research on the release of heavy metals from flyash and their bioaccumulation is needed (Theis and McCabe 1978, Theis 1979). Effects on benthic organisms are not described in the literature; however, since the ash is very fine-grained and has a much lower moisture content, significant effects on benthic organisms could be expected. No costs of flyash application are given in the literature but it is noted that ash treatment is much costlier than lime treatment (Higgins et al. 1976).

5.1.3.1.6 References

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5.1.3.2 Conclusions and Recommendations

Whereas treatment of the whole lake bottom is not considered to be feasible because of the lake's large size and the prohibitive cost, the committee recommends as a treatment for selected locations:

1. The use of fiberglass screens and/or plastic liners in selected locations to help alleviate local weed problems. This would be applicable around public and private docks, piers and swimming areas.

2. Clean sand could be used in certain areas to enhance recreation beaches and discourage macrophyte growth.

Despite the abundance of flyash at Wabamun, the committee does not recommend the use of flyash as a bottom sealant because of:

1. high content of the metals boron and aluminum;

2. probable development of detrital sediment layer on top of flyash from decomposing macrophyte growth and sediment transport from untreated areas;

3. potential problems of stirring up of flyash by lake currents.

5.1.4 WHITE AMUR (GRASS CARP)

5.1.4.1 Background Information

The white amur or grass carp (Ctenopharyngodon idella), which is not a true carp, is found naturally in certain rivers in China which flow into the Pacific. Their vegetarian diet has led to their use in the control of aquatic plants in eastern Europe, the U.S.S.R. and the United States. As a result of numerous studies, a considerable body of literature exists dealing with aspects of white amur biology.

The white amur can reach a weight of over 45 kg (99 lbs.), can tolerate low oxygen concentrations and can live in a temperature range of 0°C to 33°C (32° to 91°F). The fish feed in mid-water and at the surface and do not appear to disturb the bottom sediments in their feeding activities, unlike members of the carp family. Young fish eat animal material but, as they mature, they become almost exclusively vegetarian. The change to eating plants occurs sooner in warmer water but before they reach a weight of 0.5 kg (1.1 lbs.). Even large fish can be caught with lures or bait.

The amount of weed consumed by white amur depends on water temperature. At temperatures under 10°C (50°F), they eat very little and grow slowly. At 20°C (68°F), plant consumption has been measured at 50%/day of body weight, rising to over 100%/day at 22°C (72°F) (Opuszynski, 1972).

The white amur requires certain conditions for breeding. Temperature for spawning ranges from 15-30°C (59-86°F) with an optimum of 20-22°C (68-72°F). The eggs are semi-buoyant and are not attached to any substrate. They require a current to keep them suspended and supplied with oxygen until they hatch. Optimal incubation temperature is 22-26°C (72°-79°F) while, below 20°C

(68°F), egg mortality is high. Incubation time increases as temperature decreases ranging from 21 hours at 25°C (77°F) to 60 hours at 17°C (63°F). The temperature of Lake Wabamun varies from about 3-4°C (37-39°F) at the bottom in the winter to 23°C (73°F) in the summer. Discharge canal temperature can reach 28°C (82°F) in the summer. The discharge canal could act as a potential breeding area for white amur.

White amur show a degree of preference in their diet. They appear to prefer plant species which are tender and low in fibrous material. A rough ranking of grazing preference has been compiled from several sources by Cross (1969).

Canadian pondweed	Elodea canadensis
Hornwort	Ceratophyllum demersum
Stonewort	Chara spp.
Lesser duckweed	Lemna minor
Broad-leaved pondweed	Potamogeton natans
Ivy-leaved duckweed	Lemna trisulca
Eurasian water milfoil	Myriophyllum spicatum
Fennel-leaved pondweed	Potamogeton pectinatus
Great reedmace (Cattails)	Typha latifolia
Common reed	Phragmites communis
Common rush	Juncus effusus
Black sedge	Carex nigra
Frogbit	Hydrocharis morsus-ranae
Watercress	Nasturtium officinale
Shiney pondweed	Potamogeton lucens
Sedge	Carex pseudocyperus

White amur have no teeth and rely on pharyngeal teeth to masticate their food. In addition, their gut length is exceptionally short (Cross, 1969). The efficiency of digestion is low, generally less than 50% (65% for Lemna spp. Van Dyke and Sutton; 1977). The large

amount of partially digested plant material excreted by the fish contains appreciable amounts of nutrients which have the potential to produce an increase in the growth of planktonic algae. Various authors have mentioned the possibility of algal blooms after the introduction of white amur (Alikunhi & Sukumaran 1964; Stroganov, 1963; and Prowse, 1969). No quantitative changes were given in these papers. Other studies by Terrell (1975) and Lembi et al (1978) did not find any increase in phytoplankton. Boyle (1979) and Mitzner (1978) found a reduction of nutrients and algae after two years in ponds where white amur had been introduced.

Terrell & Terrell (1975) carried out a study to evaluate the effectiveness of white amur in reducing macrophytes in three Georgia ponds which contained catfish. One-year old white amur were introduced. After one year, the vegetation in the ponds had been reduced by 88, 89 and 79%, while vegetation in the control pond remained abundant. After two years, one pond from which the fish had not been removed, had been completely denuded of floating and submersed macrophytes. One year after their introduction, the fish weighed between 1.6 and 2.1 kg (3.5 and 4.6 lbs.) and had a survival rate of 76-91%. Stomach contents consisted of 74% by volume of macrophytes and only 0.02% animal material. The latter consisted mostly of ants and earthworms which had fallen into the pond.

Stocking rate influences the quantity of vegetation grazed. Too many fish will completely remove the plants while too few would not have a significant effect on plant abundance. Too great a reduction of macrophyte cover would result in a loss of habitat for other fish species and animals. Bailey (1978) did not find any significant trend towards an increase or decrease in other fish populations after the introduction of white amur. In areas with very high macrophyte densities, an increase in fish populations may occur after a reduction of macrophytes (Boyle, 1979). The

determination of an ideal stocking rate would probably have to be done on an individual lake basis.

The merits of the white amur as macrophyte grazers appears to be well founded. A significant reduction or even total removal of macrophytes can be achieved depending on stocking rate. Elodea and Ceratophyllum are amongst the most "preferred" species. Unfortunately, Chara, a desirable plant species which is also found abundantly in Wabamun, ranks high in the dietary preference of the grass carp and might be excessively grazed. Increased nutrient loading of the water from partially digested plant material would probably not cause increased algal growth if results are similar to those in other experiments but the possibility exists. The financial outlay for white amur compared to mechanical harvesting is extremely favourable and the use of these fish to control macrophytes does not build up potentially harmful residues as herbicides can do. While the white amur is regarded by many as a good food fish, it is likely to have difficulty gaining acceptance in North America because of its carp name.

A comprehensive study carried out in British Columbia (Fedorenko and Fraser 1978) reviewed the possibility of introducing carp into the Okanagan lakes as a method of controlling weed growth. Objections to its use in B.C. were raised primarily on the basis of introducing an exotic species which may have impacted unfavourably on existing fish populations and spread into neighbouring provinces.

In summary, the negative aspects of introducing grass carp to control macrophytes are:

1. The potential for this exotic species to reduce or displace native fish populations through competition for food and space, interference with spawning, and alteration of fish habitat.

2. Lack of ability to control the locations where grass carp would reduce weed abundance. Some macrophyte beds, for example, are essential as pike and perch spawning areas and it would not be desirable to remove them by whatever means.

3. The possibility of spread of introduced white amur into neighbouring provinces and man's lack of ability to control their spread and abundance.

4. Juveniles select animal food such as benthos and zooplankton in preference to vegetation.

5. Adult white amur are omnivorous, preying on animal food when macrophyte supply is low.

5.1.4.1.1 References

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5.1.4.2 Conclusions and Recommendations

The Committee recognized the record of white amur as a control over aquatic plants. There are several unknown factors involved, not the least of which is the fact that each inland lake is a separate entity, with its own peculiarities due to size, depth, water chemistry, watershed soil conditions and existing plant and animal life. Lake Wabamun as a suitable habitat for white amur is unknown; thus, only an actual field test in a similar but isolated lake could answer such questions. The Committee believes that such field tests should be conducted without delay.

1. The introduction of white amur (grass carp) should not be used at this time for weed control in Lake Wabamun because of unknown ecological effects. Regulatory restrictions and the possible spread of the species throughout the Saskatchewan-Nelson River system may also prohibit its use.

2. The Fish and Wildlife Division, in cooperation with Alberta Environment, should do experimental work with grass carp to evaluate their future use as potential aquatic weed control agents.

5.1.5 WEED HARVESTING PROGRAM

5.1.5.1 Background Information

The growth of aquatic plants in Lake Wabamun has caused concern to users of the lake for over fifty years. A weed cutter was used at Seba Beach in the 1930's to clear weeds from the beach area. In May 1961, the herbicides acrolein and 2,4-D were tested in the east end of the lake and, at that time, herbicides were deemed to be inefficient and too costly to provide adequate control.

Various consultants have indicated that weed harvesting is an effective means of control. In 1973, Reid Crowther indicated that harvesting is relatively inexpensive and permits recreational activities to continue, does not drastically affect fish habitat and does remove nutrients. Nevertheless, it is not a permanent remedy.

Dr. Gallup, who was with the University of Alberta, reported in 1973 and 1975 that, in the harvested areas, the populations of snails increased while invertebrates (chironamids & amphipods), which are food for fish, decreased. Few other species were affected and most of the mud-dwelling organisms remained. These

changes were felt to have little effect on whitefish. Dr. Gallup recommended that some vegetation be left over winter, that cutting be restricted to depths greater than 1 m (3.3 ft.) and that harvesting commence after June 15.

In 1979, International Environmental Consultants stated that expanded weed harvesting was the only alternative with significant beneficial impacts and minor negative ones.

In 1980, Beak stated that harvesting reduced the formation of rafts of weeds thus reducing the risk of spread.

The removal of nutrients was equated to that of the commercial fishery and was considered insignificant with respect to the total nutrient load.

Weed harvesting can be successful in reducing waterweed problems as indicated by weed harvesting reports presented to this Committee by TransAlta Utilities Corporation. A copy of their 1982 report can be found in Appendix 7.

Harvesting aquatic plants can act as a lake restoration technique when the quantity of nutrients removed from the lake by the harvest exceeds the input of nutrients from the watershed and other sources. However, with the relatively small amount of phosphorus taken up annually by the plants, this means that phosphorus loading to the lake must be greatly lowered. With the very thick bottom sediments containing available nutrients in Lake Wabamun, the effect of harvesting on the nutrient level would be negligible. Harvesting does remove material which would otherwise decay and consume oxygen or produce rafts which obstruct boats. The primary disadvantage of harvesting is the long time period over which the harvesting program must be maintained along with the continual cost.

5.1.5.2 Operation of the Harvesting Program

In 1971, the Department of Lands and Forests purchased weed harvesting equipment and used it in the lake. In 1972, TransAlta (formerly Calgary Power) leased the equipment and initiated a weed harvesting program in the vicinity of the Wabamun discharge canal.

The weed cutters made by Aquamarine of Waukesha, Wisc. use a 2.4 m (7.9 ft.) mower blade which can be lowered to a maximum depth of 1.5 metres (5 feet). The cut plants are carried to the surface and deposited in a storage area by a mesh conveyor belt. Due to the 1.5 metre (5 feet) cutting depth, weeds growing in deeper water are not entirely removed.

A systematic cutting pattern is difficult to achieve in the open lake but the establishment of a grid system of marker buoys does help to reduce overlap and missed areas. Use of the cutters in shallow water is limited to 0.6 m (2.0 ft.) required for flotation and operation of the paddle wheels. Obstacles such as docks and water lines also hamper their use near shore.

Operation of the weed harvesting program has been managed by TransAlta since 1972. Expansion was required by the Energy Resources Conservation Board as part of TransAlta's operating license since 1981. The grid area harvested consists of squares (152 m x 152 m) (500 ft. x 500 ft.) originally having a total area of 128 hectares (316 acres). This was expanded to 148 hectares (365 acres) in 1981. Harvesting normally starts in mid-May and stops at the end of August. Records of the amount of weeds harvested have been kept since 1972 when the harvesting program commenced. The average wet weight harvested in tonnes per hectare in the grid area is shown in Figure 1(a). Water content of these plants is approximately 85%.

WEED HARVESTING PROGRAM

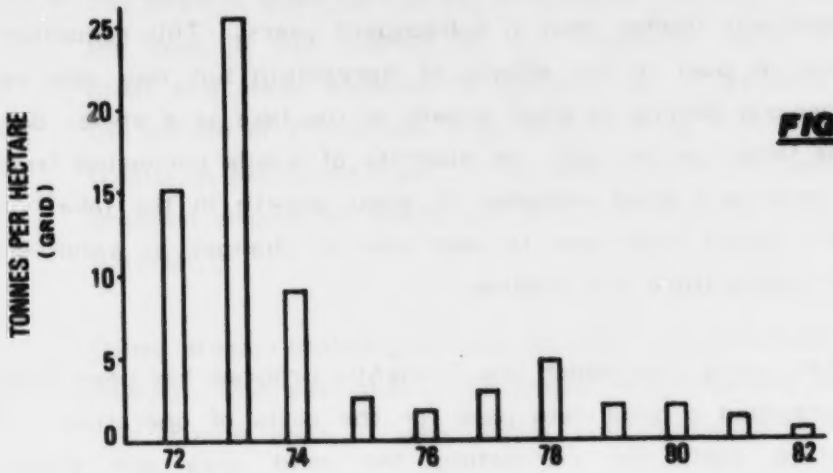


FIGURE 1(a)

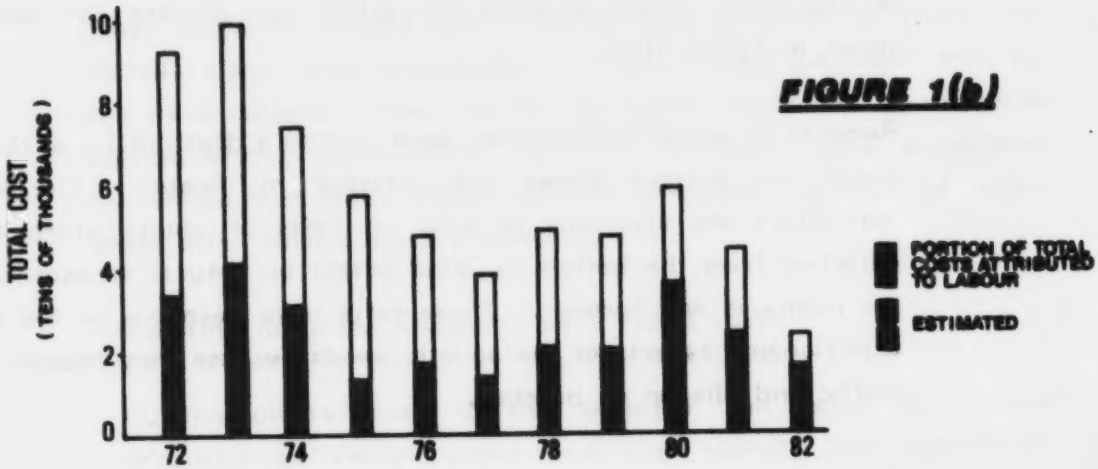


FIGURE 1(b)

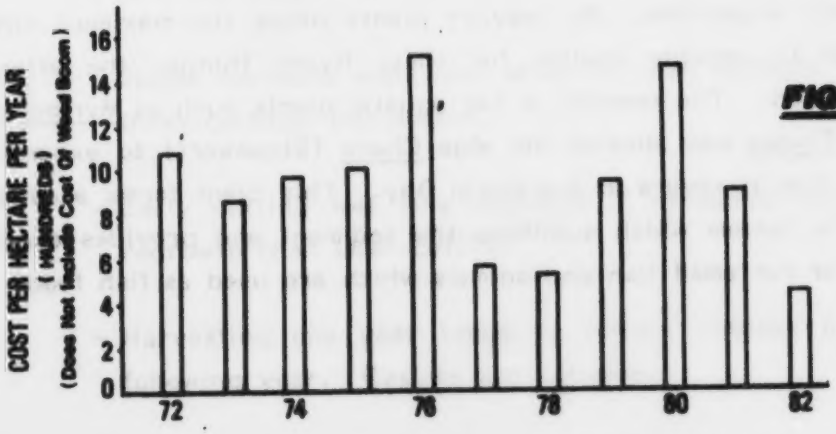


FIGURE 1(c)

Source: TransAlta Utilities Lake Wabamun Aquatic Weed Control Program 1972 – 1982

The amount harvested in the first three years of the program was substantially higher than in subsequent years. This reduction may be due in part to the effects of harvesting but may also reflect the general decline in weed growth in the lake as a whole. Because of the large sample size, the quantity of weeds harvested from the grid area is a good indicator of weed growth in the lake. Weed growth varies from year to year due to changes in water levels, water temperature and weather.

The ten years over which the TransAlta program has been operated has provided a good data base for the costs of operation. Total operating costs for harvesting the grid area are shown in Figure 1(b) along with the labour costs expressed as a percentage of the total. Cost of weed harvesting per hectare per year is given in Figure 1(c).

Removal of weeds from shallow water and to a depth of 1.5 m (5 ft.) below the surface allows free passage by boats. The weed harvesters are also able to pick up rafts of plants which have detached from the bottom by wind action or natural senescence of the plants in mid-summer. These rafts have been one of the most objectionable aspects of the aquatic weeds because they impede boat traffic and pile up on beaches.

Weed harvesting has some effect on the habitat of fish and other aquatic organisms. By leaving plants below the maximum cutting depth to provide shelter for these living things, the effect is minimized. The removal of tall aquatic plants such as Myriophyllum and Elodea has allowed the alga Chara (Stonewort) to expand the area that it covers in Kapasiwin Bay. This plant forms a covering on the bottom which stabilizes the sediment and provides excellent shelter for small fish and animals which are used as fish food.

The present weed harvesting program carried out by TransAlta covers the area in the vicinity of the discharge canal of the Wabamun plant and areas adjacent to the intake. It extends eastward from the middle of Pt. Alison to a line running south from the railroad trestle at Moonlight Bay. This area has, in the past, produced the greatest amount of weeds and was the origin of most of the rafting material.

Other areas requiring cutting at times are Moonlight Bay and Seba Beach. The west side of Goosequill Bay also has weed beds which can impede boats in some years, but recreational use of this area is not heavy.

Many property owners are bothered with growths of reeds and cattails along their waterfronts. These cannot be dealt with by the weed cutters. They can be effectively controlled by repeated cutting with a scythe below the water surface. Local experience has shown that these plants will not re-invade the area for a few years after such a cutting program.

Harvesting programs elsewhere have found that:

- Cutting plants close to the sediment and below the leaves produced less regrowth and lower plant density than cutting off only the tops.

- Single harvests were less effective than multiple harvests; e.g. three cuttings per season.

- Early cutting was less effective in reducing plant density and regrowth than later cutting.

- Harvesting one year tends to reduce biomass in the area the following year. Results are variable.

- Shallow water cutting must be done more frequently than in deeper water because less growth is required before they reach the surface and more light is available for plant growth.

The weed harvesting program operated by TransAlta for ten years on Lake Wabamun has successfully reduced the nuisance growth of aquatic plants in the grid area. A significant reduction of rafting in Kapasiwin Bay, compared to the 1960's, has improved the eastern end of the lake for recreational use. An expansion of the harvesting program could improve other areas of the lake in a similar fashion.

5.1.5.3 Questionnaire

In conjunction with the technical review of the weed harvesting program, the committee undertook to determine whether or not the public viewed the existing program as satisfactory and whether or not the public would be prepared to pay, on a user pay principle, a portion of the costs of an expanded program. A survey was designed and copies distributed to four groups, those being:

1. the general cottage population (1500 copies sent);

2. members of the three sail/yacht clubs (250 copies sent);

3. summer village councils and the county (1 county, 5 summer villages); and

4. general lake users (done at the 1983 Sportsman's Show - 48 copies filled out).

Following is a breakdown of their responses. Due to the nature of the responses from the County and the summer villages, it was not

possible to include a breakdown of their responses to each question.

Question 1 Do you feel that the existing weed harvesting program on Lake Wabamun has sufficiently dealt with the issue so that weeds are no longer a problem on the entire lake?

	Cottagers n = 49	Sailing/ Yacht Clubs n = 26	Summer Village/ County n = 3	General Lake User n = 48	Total n=123
Yes	20%	27%	-	27%	24%
No	80%	73%	-	73%	76%

Question 2 In your opinion, is an expanded weed harvesting program needed to improve the recreational use of the lake?

	Cottagers n = 49	Sailing/ Yacht Clubs n = 27	Summer Village/ County n = 3	General Lake User n = 48	Total n=124
Yes	75%	63%	-	80%	74%
No	25%	37%	-	20%	26%

Question 3 Are you personally affected by excessive weed growth?

	Cottagers n = 54	Sailing/ Yacht Clubs n = 28	Summer Village/ County n = 3	General Lake User n = 48	Total n=130
Yes	57%	71%	-	62%	61%
No	43%	29%	-	38%	39%

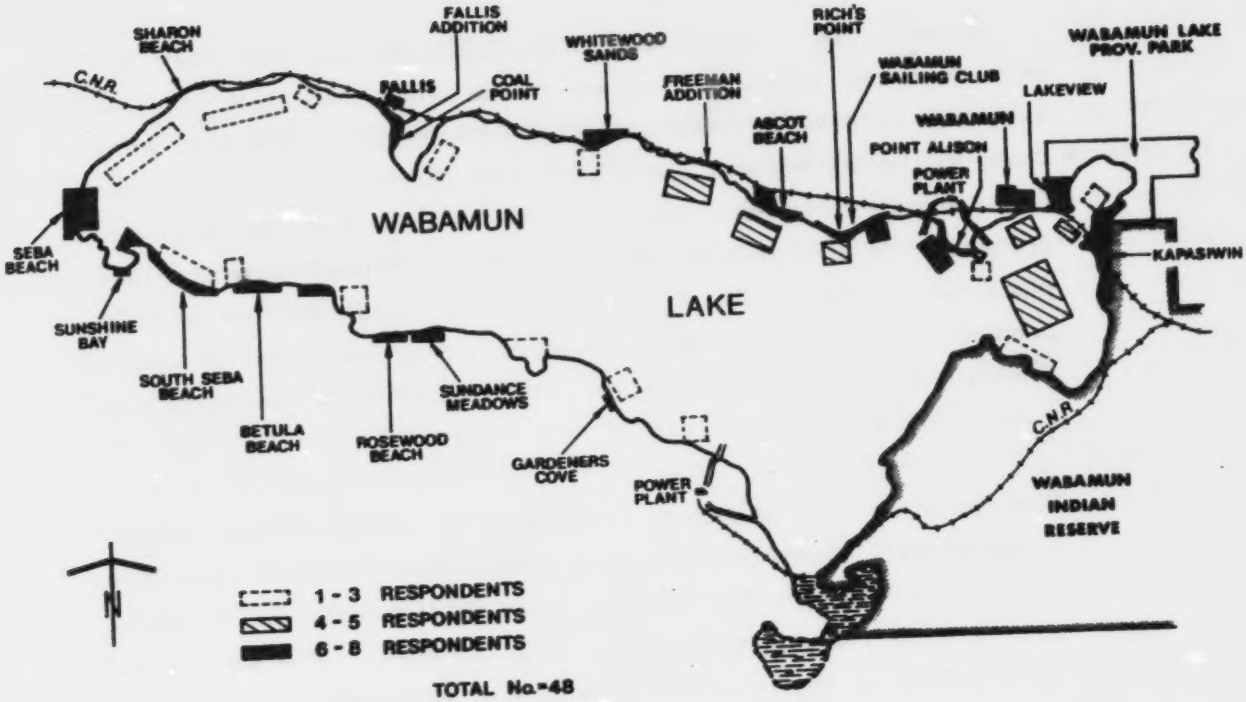
If yes, which activities are affected?

	Cottagers n = 54	Sailing/ Yacht Clubs n = 31	Summer Village/ County n = 3	General Lake User n = 48	Total n=133
use of beach front property	41%	35%	-	40%	39%
motor boating	41%	3%	-	35%	30%
sailing	28%	55%	-	21%	32%
waterskiing	30%	16%	-	29%	26%
fishing	37%	16%	-	44%	35%
swimming	50%	55%	-	54%	53%
other	2%	3%	-	-	2%

Question 4 Would you be prepared to pay a portion of the weed harvesting costs (to be assessed against lake users affected) in order to minimize the problems you experience?

	Cottagers n = 51	Sailing/ Yacht Clubs n = 25	Summer Village/ County n = 3	General Lake User n = 48	Total n=123
Yes	25%	60%	33%	49%	42%
No	67%	40%	67%	51%	58%
Possibly Pay	8%				

Question 5 On the map below, please identify with an (x) your current property on the lake and shade (///) any portion of the lake where you feel weeds should be harvested.



As the map indicates, respondents had a wide range of opinions where weeds were a problem. Three major areas stand out; the area immediately off Seba Beach, the eastern portion of Sunshine Bay, and Pt. Alison. It would appear, from the public's perspective, that these areas in particular could benefit from an expanded program. Other areas which were also pointed out as needing harvesting include Ascot Beach, the area extending from the Village of Wabamun across the Lake to Kapasiwin, Rich's Point and Freeman Addition.

Total responses received for each of the groups is as follows:

1. General Cottagers = 55 (or 4% of the total mailed out)
2. Sailing/Yacht Clubs = 31 (or 12% of the total mailed out)
3. Summer Villages/County = 3 (or 50% of the total mailed out)
4. General Lake Users = 48

In reviewing the public's response, it is evident that they not only find the existing program to be inadequate but that an expanded program is required. It is interesting to note that while those in the sailing and yacht clubs feel that the current program is inadequate, they are not as strong in demanding an expanded program. It is possible that, since most of their activites take place out in the middle of the lake where weeds are not a major problem, they are less likely to insist on an expanded program. The largest group of respondents (53%) indicated that swimming was affected by weed growth.

The question on financing provided the greatest split among respondents. Both the cottagers and summer villages (with the exception of Betula Beach, who were in favour), were solidly against paying any portion of the costs involved. The sailing and yacht clubs, on the other hand, indicated a definite trend towards paying, while there was a 49-51 split against paying among general lake users. It is interesting to note that of the 22 cottagers who indicated that their use of beach front property was affected by weed growth, only 9 (41%) stated that they would not be prepared to pay a portion of the costs.

While a trend does exist indicating that among those directly affected there is a willingness to assume a portion of the costs of an expanded program, the overall response would indicate the contrary.

This coupled with the fact that 39% indicated that they had problems with weeds and the use of beach front property would give credence to the conclusion that since weeds tend to cause the greatest difficulties for activities immediately along the shoreline, an expanded program should focus on weed infested areas close to the shoreline.

5.1.5.4 Weed Harvesting Authority

To undertake and administer an expanded weed harvesting program for Lake Wabamun, the Committee discussed the possibility of setting up a "Weed Harvesting Authority". Membership on the authority could come from interested agencies, municipalities and/or associations such as the following:

Alberta Environment
Alberta Recreation and Parks
Alberta Fish & Wildlife
Paul Band
County of Parkland
Village of Wabamun
TransAlta Utilities
Lake Wabamun Preservation Assoc.
Wabamun Home Owner's Association
Betula Beach
Kapasiwin
Seba Beach
Lakeview
Pt. Alison
Sunshine Bay Yacht Club
Edmonton Yacht Club
Wabamun Sailing Club

There is legislation relevant to the formation of a Weed Harvesting Authority contained in:

- Department of the Environment Act (Sec. 7(a))
  Allows the Minister to enter into an agreement with other governments, municipalities

- Municipal Government Act (Sec. 113 (1,2))
  Allows municipalities to enter into joint agreements with other

municipalities for the purposes of the ... operation or use of a public work...
Allows municipalities to appoint one or more of its members to a joint committee to oversee the above

- Alberta Regulation 51/76 Environment Grants (2) and Schedule 1(1)(a)

  Allows the Minister of Environment to make grants for the purpose of any programs... relating to the...utilization or management of natural resource to a municipal corporation in Alberta

Weed harvesting could take place in two phases - general lake improvement and localized harvesting. General lake improvement would encompass the harvesting of all areas generally classified as public areas including the areas around the pier at the Provincial Park, the public pier at Seba, the area immediately adjacent to the pier at Wabamun and for picking up and harvesting all weed rafts. Specific localized harvesting would be carried out on a request for service basis, paying particular attention to the summer villages, the Provincial Park, subdivisions and other densely utilized areas. All weed harvesting requests would be reviewed to ensure that the effect on fisheries would be minimal. This review could be done by the Authority with input from Fish & Wildlife.

The Authority would undertake responsibility for the financing of the weed harvesting program on a "user pay" principle. The total cost for the general lake improvement would be assessed against the provincial government (for the public areas and general public lake users) and TransAlta (for its current harvesting operation). The costs involved in the specific localized harvesting would be assessed against the municipality or group requesting it. This could be collected as part of the taxes in a summer village or by

the county as a local improvement tax. A cost per acre could be calculated and this would form the basis for the fee schedule.

The setting up of the "Weed Harvesting Authority" would probably require initial support and input by the provincial government. This could include:

1. confirmation of the acceptance of an expanded weed harvesting program;

2. terms of reference for the authority;

3. membership; and

4. initial capital costs (loan or grant) required to start up operations.

Alternatively, as TransAlta has operated a successful program for some 10 years, with input (financial and otherwise) from the other lake users (public and private), they could be the means whereby an expanded weed harvesting program could be initiated and, if successful, developed into a full program under the direction of a lake users' Weed Harvesting Authority.

5.1.5.5 References

Beak Consultants, Ltd., 1980. The effects of thermal discharges on the aquatic plants and other biota of Wabamun Lake Alberta. Vol. 1. Report to Calgary Power Ltd. 380 pp.

Calgary Power Ltd., 1979. Lake Wabamun aquatic weed control program. 1979. 7 pp.

Energy Resources Conservation Board, 1981. Wabamun Power Plant alternative cooling studies. Decision 81-6; Application 800276 Calgary, Alberta.

Gallup, D.N., J. Rasmussen and M. Hickman, 1973. Effects of aquatic macrophyte harvesting and herbicide application on the biota of Lake Wabamun, Alberta. Report to Alberta Environment, University of Alberta. 74 pp.

Habgood, Helen, 1983. Lake Wabamun Literature Review. Prepared for Lake Wabamun Watershed Advisory Committee.

International Environmental Consultants Ltd., 1979. Environmental overview of alternative cooling facilities for the Wabamun power plant. Report to Calgary Power Ltd.

Mitchell, Patricia, 1981. Lake Wabamun Eutrophication Study; Interim Report, Water Quality Control Branch, Pollution Control Division, Alberta Environment.

Mitchell, Patricia, 1983. Lake Wabamun Eutrophication Study; Preliminary Conclusions and Recommendations, Water Quality Branch, Pollution Control Division, Alberta Environment.

Reid, Crowther and Partners Ltd. 1973. Lake Wabamun Study. Prepared for Alberta Environment. 155 pp.

5.1.5.6 Recommendations

1. The weed harvesting program on Lake Wabamun be expanded in selected areas of the lake beyond those already harvested by TransAlta Utilities.

2. The expanded weed harvesting program be on a user pay basis with:

   a. the Province of Alberta responsible for the public facility areas (e.g. public launching areas, public beaches, provincial parks, etc.) and the general public lake users' assessment coming from outside the immediate lake area;

   b. TransAlta continuing to be responsible for the area they are now harvesting as recommended by the ERCB; and

c. the various associations and municipalities responsible for any weed cutting requests they may make.

3. A Lake Wabamun Weed Harvesting Authority composed of lake users be set up to administer the expanded weed harvesting program.

4. TransAlta be requested and given the support (financial and otherwise) to initiate and test an expanded weed harvesting program. In this manner, the need for an expanded Harvesting Program and Weed Harvesting Authority could be determined by the number of requests for additional harvesting. Compensation to TransAlta would come from the Provincial Government for public areas and those requesting harvesting in privately owned areas.

5.1.6 Summary and Conclusions of Weed Growth

Lake Wabamun is one of Alberta's most heavily used recreational lakes due to its size, proximity to Edmonton and relatively good water quality. The lake is typical of shallow productive prairie lakes supporting dense summer growths of aquatic macrophytes (weeds) which are a nuisance to lake users. An annual cutting and weed removal program carried out by TransAlta in the discharge area at Wabamun has been effective in alleviating the nuisance. Naturally occurring weed growths in other parts of the lake continue to be a nuisance to lake users.

In general, several methods of controlling weed growth in lakes are available and have been considered by the committee and their application to the situation occurring in Lake Wabamun.

1. Weed harvesting, which has been recommended by several reports, has proved itself in Lake Wabamun through practical application.

2. Alternate cooling schemes for the Wabamun plant have been studied; most would be very expensive, probably would not alleviate the problem and some would have major negative impacts. Elimination of the Sundance discharge did not reduce the weed problem in that area. Alternate cooling schemes would not reduce weed growth in the whole lake.

3. Sediment dredging has been used very effectively in smaller lakes. Dredging both deepens the lake and removes the prime nutrient source and so provides a fairly long-term solution to lake enrichment. Its extremely high costs makes this alternative impractical in Wabamun. Wabamun contains very thick sediments, up to 16 m (52.5 ft.) and the removal of the top layers would simply expose deeper layers of sediment.

4. Herbiciding can be effective but regrowth occurs fairly rapidly. Good application techniques to achieve efficient killing are required. There are potential hazards to people and lake biota, especially when used on a large scale. In other areas, herbiciding has resulted in serious public objections.

5. Flushing with River Water (see Item 5.2.3). Nutrient levels in the Saskatchewan and Pembina Rivers are not much lower than in Wabamun Lake. This would make it necessary to use large volumes for lake dilution. Volumes required are above those available. Cost would be extremely high. Heavy silt loads in the Saskatchewan River would have to be removed to prevent their deposition in the lake.

6. Use of Herbivorous Fish. The white amur has been introduced into areas of the United States and has been proven quite effective in reducing weeds. Its efficacy in Canada is not known. Objections have been raised to the introduction of this exotic fish in other areas.

7. Reduction of nutrient loading to lake through:

   a. Watershed Controls and Sewage Control. In principle, these controls will help to slow the maturation of the lake. The large amount of nutrients already in the lake will continue to recycle and the lake will remain productive even if nutrient inputs are greatly reduced.

   b. Chemical Precipitation of Nutrients. (See Item 5.2.2.) The addition of chemical precipitating agents, i.e. iron or aluminum salts, to the water is used in the purification of water for domestic and industrial use but the high cost of such treatments for a lake the size of Wabamun makes it impractical.

   c. Bottom Barriers. Effective in localized areas, such as around docks and piers, but impractical for large areas because of cost and maintenance problems.

The committee was formed principally to look at the problem of weed growth in Lake Wabamun and in its early meetings identified "weed growth" as the primary concern of lake users. Subsequently, the committee brought in a wide variety of expertise, reviewed studies and received considerable public input. Of the several control measures available, "mechanical weed harvesting" is the most feasible to alleviate nuisance weed growth in Lake Wabamun. This applies now and in the near future (5-10 years). In the long term, depending upon research, other methods such as herbiciding, herbivorous fish or some new technology could develop into a more acceptable, efficient and a less costly method.

5.2 WATER QUALITY

5.2.1 THE LAKE WABAMUN EUTROPHICATION STUDY

The eutrophication study concluded that Lake Wabamun has good water quality when compared with other lakes in the Edmonton area. Figure 2 shows that the lake may be designated meso-eutrophic. Although rooted plants are a nuisance in some areas, blue-green algal blooms are rarely observed.

The present condition of the lake is related to its nutrient supply. If the supply increases because of activities in the watershed, the long term result may be reduced water clarity, increased algal populations and the potential for fish kills.

Since the major source of nutrients to the lake is the watershed, control of nutrients through appropriate land use practises is required. This should be done through education of land/cottage owners, land use bylaws and development regulations.

5.2.2 SEPTIC SYSTEMS AND SEWAGE DISPOSAL

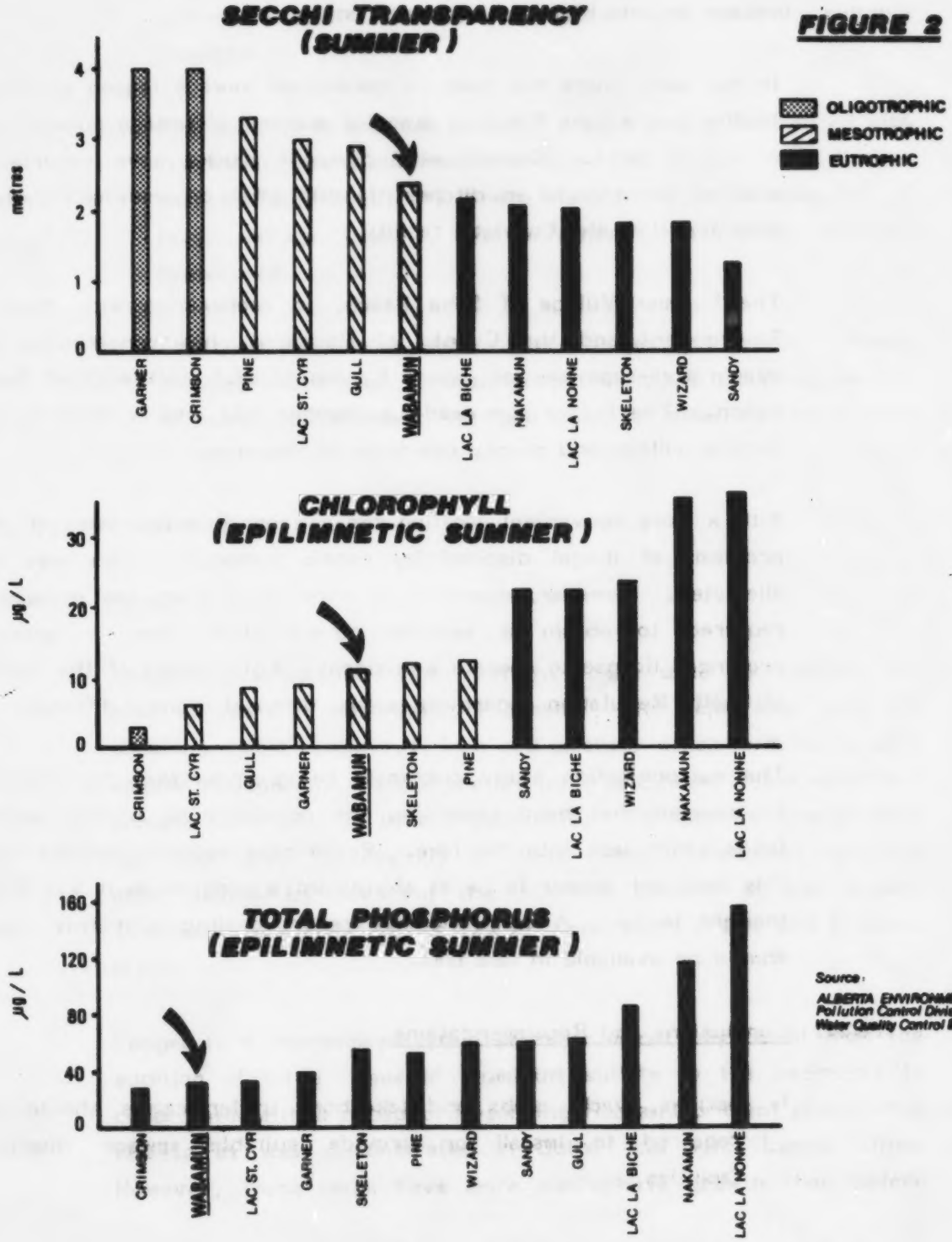
5.2.2.1 Background Information

The problems involved in sewage disposal around Lake Wabamun were identified in the committee's early stages as an issue which required some action. Complaints had been received that yachts and large sailboats had been observed dumping sewage from their holding tanks or portable toilets into the lake. Boat owners, on the other hand, complained about the lack of publicly available facilities for sewage handling.

The Provincial Board of Health Regulations respecting nuisances and general sanitation, Section 34-13-2, prohibits the depositing of

TROPIC STATE OF LAKE WABAMUN IN COMPARISON WITH OTHER ALBERTA LAKES

FIGURE 2



Source:
ALBERTA ENVIRONMENT
Pollution Control Division
Water Quality Control Branch

Lake Wabamun Watershed Advisory Committee

sewage into any surface water, onto any land in a city, town or village or onto highways, roads or streets.

In the past, there has been no convenient sewage lagoon or other facility in the Lake Wabamun area for disposal of sewage pumped out of septic tanks. Occasionally, pumpout trucks have reportedly dumped the material in ditches, landfill sites or elsewhere rather than travel to the Entwistle facility.

The Summer Village of Seba Beach, in cooperation with Alberta Environment and the County of Parkland, has constructed an evaporative-type sewage lagoon 1.6 km (1 mi.) northwest of Seba Beach. The lagoon was ready September 1982 and is used by all summer village and county residents in the area.

With a more convenient location for sewage disposal, some of the problems of illegal disposal by septic pumpout trucks may be alleviated. However, operators of these trucks are not presently required to obtain a specific permit other than a general provincial license to operate a business. Enforcement of the Board of Health Regulation regarding sewage disposal is very difficult.

The eutrophication study currently being undertaken by Alberta Environment has been examining the possiblity of cottage septic fields which leak into the lake. Preliminary reports indicate that this does not appear to be as significant a problem as it was first thought to be. A comprehensive report dealing with this issue should be available in late 1983.

5.2.2.2 Conclusions and Recommendations

1. Marinas, yacht clubs and lakeshore trailer camps should be required to install or provide suitable sewage disposal facilities.

The committee further recommends installation of a public pumpout facility for boats located at several suitable locations.

2. Operators of septic tank pumpout trucks should be licensed with Provincial Board of Health and/or the County; the license should state specifically where material is to be disposed of (e.g. sewage lagoon), and infractions should be severely prosecuted.

   The committee also suggests that villages and summer villages utilizing septic tank services should work out group agreements to pump out all tanks at one time to make servicing more economical.

5.2.3 CHEMICAL TREATMENT

5.2.3.1 Background

Chemical precipitation of nutrient has been used successfully for over 40 years in wastewater treatment. The major ions used are aluminum (most commonly), iron and calcium, which form bonds with soluble phosphorus, reduce the phosphorus content of the water and enhance precipitation to the sediments. Phosphorus precipitation has been used successfully on small lakes in reducing nuisance algal blooms by lowering the nutrient content of the water. Treatments are effective for two to three years (Funk and Gibbons 1979).

Longer term improvement (five years or more) may result from the addition of large doses of aluminum sulfate to the sediments to cover them with a phosphorus-sorbing floc and prevent phosphorus release as was demonstrated at Dollar and Twin Lakes, Ohio. However, these lakes have more macrophyte growth than before

treatment, probably due to greater light transparency. Labour costs for phosphorus inactivation run to 4 man-days/hectare (1.6 man-days/acre) and large amounts of chemicals are required (e.g. 3 to 4 tonnes/ha) (1.3 to 1.8 tons/acre) (Cooke and Kennedy 1980). Chemicals are expensive and cost escalates rapidly with the size of lake (Theis 1979).

Chemical nutrient precipitation has been used to reduce nuisance algal blooms by reducing phosphorus concentrations in the water. Rooted plants could still obtain phosphorus from the sediments. For example, at Horseshoe Lake, Wisc., although algal blooms were eliminated, Chara, a rooted plant, increased in abundance following aluminum sulfate treatment (Peterson, et al. 1973), and macrophytes increased after nutrient interaction treatment of West Twin Lake, Ohio (Cooke and Kennedy 1980).

5.2.3.1.1 References

Cook, G. Dennis and Robert H. Kennedy, 1980. Phosphorus inactivation: a summary of knowledge and research needs. Restoration of Lakes and Inland Waters. Internat. Symp. on Inland Waters and Lakes Restoration. USEPA 440/5-81-010.

Funk, Wm. H. and Harry L. Gibbons, 1979. Lake Restoration by nutrient inactivation. Lake Restoration; Proc. Nat. Conf. USEPA 440/5-79-001. 141-151.

Peterson, James O., et al., 1973. Eutrophication control: nutrient inactivation by chemical precipitation at Horseshoe Lake, Wisconsin. Tech. Bull. No. 62, Dept. Nat. Res., Wisc.

Theis, Thomas L., 1979. Physical and chemical treatment of lake sediments. Lake Restoration; Proc. Nat. Conf. USEPA 440/5-79-001. 115-120.

5.2.3.2 Conclusion

The addition of chemical precipitating agents, i.e. iron or

aluminum salts, to the water is used in the purification of water for domestic and industrial use but the high cost of such treatments for a lake the size of Wabamun makes it impractical.

5.2.4 FLUSHING AND DILUTION OF NUTRIENTS

5.2.4.1 Background Information

Dilution implies both an in-lake reduction of nutrient concentration plus wash-out of material. Flushing implies a wash-out of material but may not necessarily reduce nutrient concentrations in the lake (Welch 1979).

The techniques of dilution and flushing have been used successfully in the U.S. to alleviate nuisance algal growth problems (mainly blue-green algal blooms) (Dunst et al. 1974, Welch 1979).

If flushing to reduce algae is to be effective, the rate of flushing must be greater than the algal growth rate (flushing rates of 2 to 12 days) (Dunst et al. 1974).

For effective dilution to reduce in-lake nutrient concentrations, the flushing rate must be 3.5 times per year and the dilution water must be of a lower nutrient concentration than the lake (Dunst et al. 1974).

5.2.4.1.1 Examples

a. Buffalo Pound Lake, Sask. (29.9 km^2; max. depth 5.6 m)
(115 sq.mi.; max. depth 18.4 ft.)
(source: Hammer 1972, in Dunst et al. 1974).

Since 1967, nutrient-poor water from Lake Diefenbaker has been used for dilution of Buffalo Pound Lake which suffered

blue-green algal blooms and winter deoxygenation. The most marked improvement occurred in the first year with gradual improvement continuing thereafter. By 1972, ortho phosphorus had decreased by 90%; blue-green algal populations declined more slowly and by 1971 were of sub-nuisance levels. The algal reduction was accompanied by an increase in the macrophyte Potamogeton pectinatus.

b. Gull Lake (80 km^2; mean depth 4.7 m)
(30.9 sq.mi.; mean depth 15.4 ft.)

Lake user complaints of declining water levels prompted the pumping of Blindman River water to stabilize the lake level. The diversion has had no apparent effect on water quality.

The diversion volume is small; water is pumped at a rate of 850 L/sec (30 cfs) and represents 1.5% of the lake volume annually (Mitchell 1981).

Gull Lake project information:

Pipeline length	1220 m	(4000 ft.)
Pipeline diameter	76 cm	(30 in.)
Flow rate	850 L/sec	(30 cfs)
Elevation difference	49.5 m	(133 ft.)
Total cost (1974)	$1.4 million	
Total cost projected to 1981	$3.4 million	

(Source: Operations and Maintenance Branch, Water Resources Management Division, Alberta Environment.)

c. Lac St. Cyr

A small volume of North Saskatchewan River water has been diverted into Lac St. Cyr since 1977 to raise water levels.

Lac St. Cyr Project information:

Pipeline length	14.5 km	(9 mi.)
Pipeline diameter	40.6 cm	(16 in.)
Flow rate	142 L/sec	(5 cfs)
Elevation difference	122 m	(400 ft.)
Total cost (1977)	$1.9 million	
Total cost projected to 1981	$4.0 million	

(Source: Operations and Maintenance Branch, Water Resources Division, Alberta Environment.)

5.2.4.1.2 Preliminary Studies, Lake Wabamun

To achieve flushing in Lake Wabamun, the hydraulic residence time (presently 8.9 years) would have to be reduced to weeks. A diversion flow of 12,000 L/sec (425 cfs) would produce a residence time of one year (Mitchell 1981). A diversion of this volume would not cause flushing of algal cells but could result in nutrient dilution if the incoming water had lower nutrient concentrations than the lake water.

A flushing rate of 12 days, which would cause wash-out of algal cells, would require a diversion inflow of 483,370 L/sec. (17,068 cfs.)

Two possible sources for diversion are the North Saskatchewan River and the Pembina River. As can be seen from the data below,

the Pembina River would not be capable of supplying 12,000 L/sec (425 cfs) continuously.

a. North Saskatchewan River at Edmonton

Mean Monthly Discharges in L/sec (cfs) 1911 - 1979

Jan.	50878	(1794)	July	537819	(18964)
Feb.	49488	(1745)	Aug.	395594	(13949)
March	53685	(1893)	Sept.	273731	(9652)
April	156235	(5509)	Oct.	137206	(4838)
May	288450	(10171)	Nov.	76629	(2702)
June	543831	(19176)	Dec.	53487	(1886)

Monthly means = 215338 (7593)

b. Pembina River near Entwistle

Mean Monthly Discharges in L/sec (cfs) 1914-1979

Jan.	2085	(73.5)	July	40668	(1434)
Feb.	2014	(71.0)	Aug.	19937	(703)
March	2864	(101)	Sept.	16931	(597)
April	24333	(858)	Oct.	11429	(403)
May	58280	(2055)	Nov.	6012	(212)
June	47276	(1667)	Dec.	3432	(121)

Monthly means - 19540 (689)

Source: Environment Canada, Inland Waters Directorate. Historical Streamflow Summary, Alberta, to 1979.

North Saskatchewan River water contains higher mean total phosphorus than the lake (river TP = 76 μg/L (76 ppb); lake

TP = 30 µg/L (30 ppb)); however algal assay experiments indicate slightly lower growth potential in river diluted lake water than in lake water alone due to the biological availability of the phosphorus (Mitchell 1981).

The mean total phosphorus of the Pembina River is more similar to that of the lake (TP = 38 µg/L (38 ppb)). Algal assays indicate that the river water has a lower growth potential than lake water (Alberta Environment, unpubl. data).

River diversion for dilution may have little effect on the weed problem since sediments provide much of the plant nutrient requirements. If dilution reduced algal growth in the water, the greater water clarity might even promote more weed growth. Siltation from the incoming river water could also be a problem.

According to Hal Cameron (Hydroelectric Branch, Water Resources Management Division, Alberta Environment), the cost of diverting 14,180 L/sec (500 cfs) of North Saskatchewan River water to Lake Wabamun would be over $100 million for the pipeline, pumps and construction alone. Additional costs would be outlet channel construction and land acquisition.

5.2.4.1.3 References

Dunst, Russell, C. et al., 1974. Survey of lake rehabilitation techniques and experiences. Tech. Bull. No. 75, Dept. Nat. Res., Madison, Wisc. 179 pp.

Mitchell, Patricia, 1981. Lake Wabamun eutrophication study interim report. Water Quality Control Branch, Pollution Control Div., Alberta Environment. 46 pp.

Welch, Eugene B., 1979. Lake restoration by dilution. Lake Restoration - Proc. Nat. Conf. USEPA 440/5-79-001. 133-140.

Welch, E.B. and M.D. Tomasek, 1980. The continuing dilution of Moses Lake, Washington. Restoration of Lakes and Inland Waters. Internat. Symp. on Inland Waters and Lake Restoration. USEPA 440/5-81-010. 238-244.

5.2.4.2 Conclusions and Recommendations

1. Flushing

Flushing implies washing out the lake with large volumes of water. The mean monthly flow of both the North Saskatchewan and the Pembina Rivers is below the amounts calculated for a flushing action in Lake Wabamun. Therefore, flushing of Lake Wabamun is not a possibility for water quality improvement or a solution to the weed problem.

2. Dilution

Dilution implies increasing the input of clean water into the lake, thus increasing the outflow and reducing the lake water nutrients to the level approaching the levels in the input water. Diversion of water from the North Saskatchewan River and the Pembina River involves a number of factors as follows:

a. Estimated flow rate required for dilution of Lake Wabamun is in the neighbourhood of 12000 L/sec (425 cfs.)

b. Rough cost estimates from either river is in the order of $100 million or greater.

c. Dilution may have little effect on the lake water nutrients used by the macrophytes as the North Saskatchewan River water contains higher mean total phosphorous than the lake water and the Pembina River water is similar to lake water.

d. Dilution with river water may have little effect on the weed problem (macrophytes) since lake sediments provide much of the plant nutrient requirements.

e. Siltation from incoming river water would have to be accommodated.

f. Wabamun Creek would need considerable upgrading to handle the outflow.

g. Dilution would require almost the entire Pembina River flow and involve an interbasin transfer of water.

Therefore, dilution of Lake Wabamun with water from nearby rivers is impractical and not a workable solution for improvement of water quality or weed growth.

5.3 LAKE LEVELS

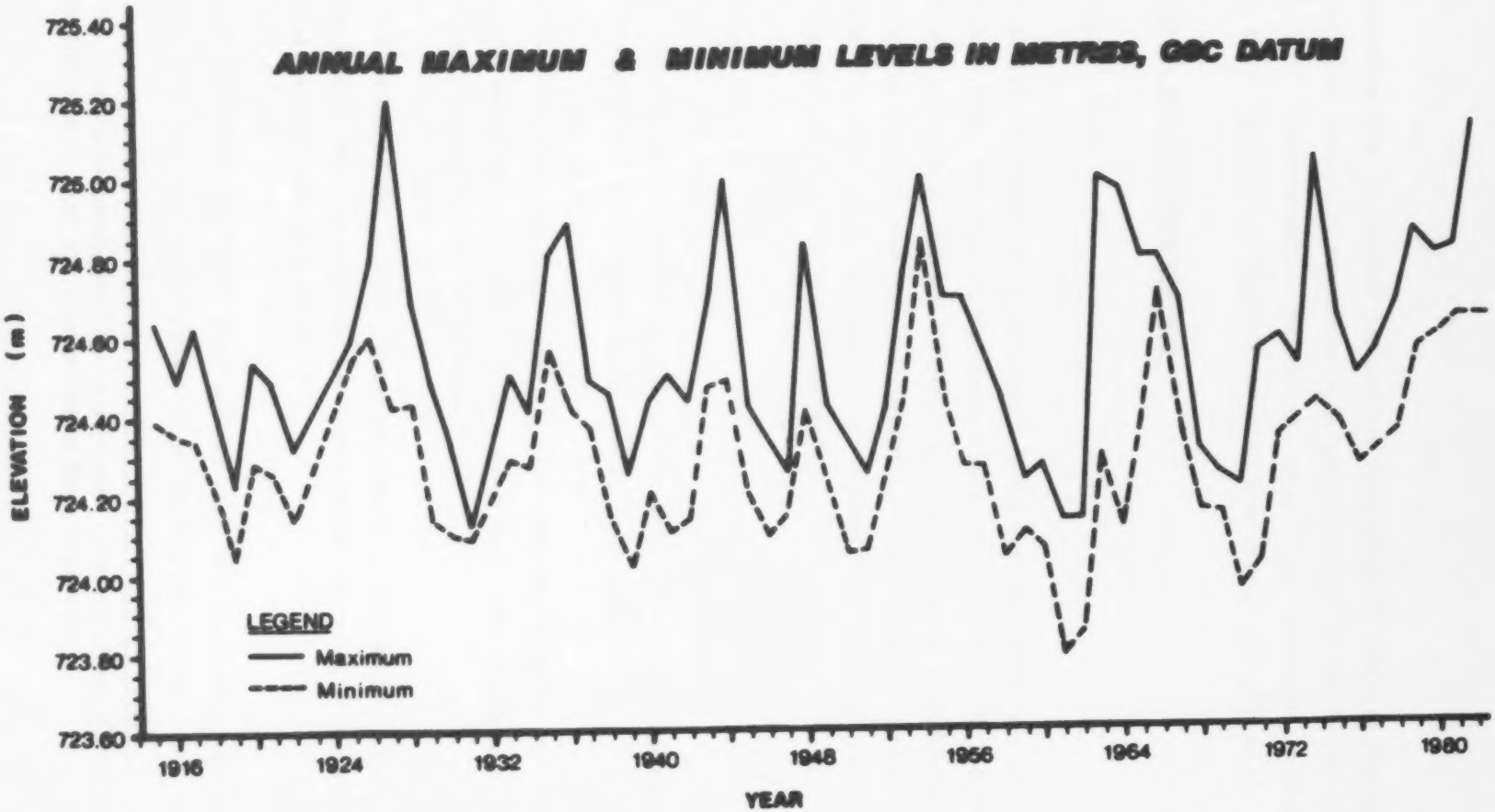
5.3.1 Background Information

The 1982 high level of Lake Wabamun was of major concern to many cottagers. Many lakeshore property owners had suffered property loss due to erosion and were concerned about effects of the high water level on septic fields. Lake level was also a major issue expressed at the public meeting on September 19, 1981. Of 29 questionnaires returned, 10 people identified lake level as being of "great concern" and for 12 others, it was of "some concern". A number of people urged that immediate action be taken to remove the beaver dams which were completely blocking Wabamun Creek.

During its 1982 helicopter tour, the committee saw evidence of the damage resulting from high water levels. This aerial view confirmed that many lakeshore cottage owners were subject to water damage.

WABAMUN LAKE LEVELS
1915 - 1982

FIGURE 3



SOURCE Alberta Environment

Lake Wabamun Watershed Advisory Committee

The committee met in special session on September 3, 1982 to review the lake level issue. A resolution was subsequently forwarded to the Minister of Environment requesting that the existing control structure be repaired or replaced so that lake levels can stabilize.

5.3.2 Conclusions and Recommendations

1. Beaver Dams

That the Minister of Environment pass on the concerns about beaver dam blockage on Wabamun Creek to the Hon. J.E. (Bud) Miller, Associate Deputy Minister of Public Lands and Wildlife, Dept. of Energy and Natural Resources, and urge Mr. Miller to take action to reach an ongoing agreement with the Paul Band to keep Wabamun Creek free-flowing.*

2. Outlet Control

WHEREAS Lake Wabamun is one of the most highly used lakes in Alberta and a major Alberta recreation resource;

AND WHEREAS the September 19, 1981 and the August 28, 1982 public meetings expressed concern over high lake levels and the damage caused by the high water;

AND WHEREAS the August 28th public meeting unanimously passed a resolution that a control be established to hold the water levels at the 1976 elevations;

AND WHEREAS the 1976 level agrees with the long time average lake level and the level agreed upon during the 1930's;

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* Subsequent to this recommendation, an agreement with the Paul Band was reached with the result that the beaver dams were removed.

AND WHEREAS the Government of the Province of Alberta has in the past conducted similar programs at other lakes;

THEREFORE, be it resolved that a program be developed by Alberta Environment for improving, repairing and/or replacing the existing outlet control structure and outlet channel to stabilize the water level of Lake Wabamun with responsibility to be on a participation basis.

5.3.3 Wabamun Lake Level Advisory Committee

The development of the Wabamun Lake Level Advisory Committee in 1982, which included representation from this committee, has allowed for an in-depth examination of the issues involved. The two committees have worked closely together through joint membership and the reporting of the Lake Level Committee's work through the LWWAC's newsletter, the Wabamun Advisor. In addition, a fact sheet was handed out by the Lake Wabamun Watershed Advisory Committee at the 1983 Edmonton Sportsman's Show.

The Lake Level Advisory Committee has been actively involved with Alberta Environment staff in overseeing the development of a water balance model. The model will examine potential water balance factors such as induced evaporation from the thermal power plant, groundwater inflow/outflow, and the effects of land use changes on watershed yield characteristics. The selected period of input data to the model will include a wide range of hydrological events and conditions which reflect the past behaviour of recorded Wabamun Lake water levels. The water balance model will be used to test a variety of lake level regulation alternatives. Any ultimate regulation works at the outlet of Wabamun lake will require that Wabamun Creek is capable of conveying the outflow to the North Saskatchewan River. The consultant's final report is to be completed by June 1983. At that time, the Advisory Committee and

Alberta Environment staff will undertake a comprehensive review of the recommendations prior to deciding on a final course of action.

5.4 LAND USE PRACTICES AND PLANNING

5.4.1 Background Information

The issue of land use in the Lake Wabamun watershed is a complex issue related to many factors. Reports were received from Mr. C. Breckenridge (County of Parkland) on the End Land Use Plan currently being developed by TransAlta Utilities and the County of Parkland for the mine areas. In addition, Ms. P. Mitchell drew the committee's attention to the relationship between land use practices and nutrient loading of the lake. Mr. Giffen of the Edmonton Regional Planning Commission (ERPC) outlined the subdivision and development problems. Given the wide range of information available and that seven municipalities are involved, as well as the Paul Indian Band, the Committee agreed that a comprehensive land management plan (covering land and water surface use) was needed. Lake management plans have been completed for six Alberta lakes and the ERPC was proposing that one be carried out for Lake Wabamun.

In general, management plan objectives can be grouped into three major categories: conservation, development and management. Conservation objectives are designed to ensure the protection and enhancement of the valued aspects of the natural environment. The development objectives are designed to ensure that new land uses and expansion of existing ones occur in accordance with good planning practice and within the development capacity of the planning area. The management objectives are designed to ensure that conservation and development objectives do not conflict and to ensure that existing and future use of the resources in the area provides the maximum benefits to Albertans at the local, regional and provincial levels.

The specific management plan objectives are as follows:

Conservation

- Maintain the natural beauty of the area and the quality of the natural environment.
- Maintain and protect wildlife populations and habitats.
- Maintain or enhance water quality.
- Maintain or enhance the quality of the sport fishery.
- Maintain or enhance the resources of the area.

Development

- Establish the level of existing use and the development capacity of the lake.
- Identify and avoid areas of severe limitations to development.
- Allocate the remaining development capacity so as to balance public serving uses, private development uses and industrial uses in line with the lake's regional role.
- Encourage quality developments with high standards of design and servicing.
- Establish priorities and timing to enhance development of the various resources in the area.
- Ensure that development proceeds in an economic and orderly fashion.

Management

- Ensure the safe and orderly use of the lake's surface and shoreland.
- Improve access to the lake for existing and future users for both summer and winter recreation.

- Make recommendations regarding existing land uses and land use practises in order to reduce sources of nutrients to the lake and the rate of lake eutrophication.
- Minimize the impact of new developments on existing residents.
- Maximize the benefits of all the resources in the area.

On October 21, 1981, members met with the Alberta Planning Board to support the proposed Lake Management Plan and urged that it not be delayed because of the recent annexations which changed the Planning Commission boundaries. Agreement was reached on Phase One (information gathering) and it has been completed under the auspices of the Yellowhead Regional Planning Commission. This phase, which concentrated on developing the necessary background material for preparation of the main plan, produced a variety of information including a current land use inventory, a bathymetric contour map of the lake, as well as maps outlining soil classification and shoreline capability. The major portion of work in the development of a lake management plan is to occur in Phase Two. Funds to cover this portion of the study remain to be allocated; however, the Yellowhead Regional Planning Commission has made a request for funds to the Alberta Planning Board. Mr. G. Allen of the Y.R.P.C. has informed the committee that the main objective would be to protect the lake through the development of an area structure plan. This plan would not only identify sites suitable for future development but would allocate land use as well as having a water surface zoning component. The water surface zoning would identify areas restricted for swimming as well as placing restrictive speed limits on portions of the lake. The multi-disciplinary planning team is backed up by extensive involvement of the public, local municipal governments and information programs.

The eutrophication study, under the direction of Ms. P. Mitchell, reached important conclusions on the relationship of land use to land

water quality. During the study, nutrient loading from various land uses was measured and other sources of nutrients were either measured or estimated.

The most important external source of nutrients to the lake was its watershed. Watershed areas remaining in natural vegetation contributed fairly low quantities of nutrients. Those areas that are cleared for agriculture or development contributed nutrient loads up to five times higher. The highest loads were from areas most intensively used for agriculture, including cattle pasture.

Because coal mining disturbs a large portion of the watershed, drainage from mine areas on the north and south side of the lake accounted for 21% of the total external phosphorus load.

Even though sewage effluent from cottages was not found to be an important source of nutrients when compared to all other sources, cottaging activities could stimulate plant growth in localized areas.

The most important conclusion from the eutrophication study is that land use practises within the entire watershed may ultimately decide the fate of the lake. Since increased nutrients usually result in increased quantities of algae in a lake, preservation of recreational water quality requires nutrient control through improved land use practises.

The following recommendations were derived from these conclusions:

- Landowners within the watershed should be encouraged to improve land management practises to minimize nutrient export on a low cost voluntary basis.

- Nutrient control measures should be required for all new construction, road buildings, resource extraction, or other projects which could disturb the land surface.

- TransAlta Utilities should reduce sediment and phosphorus loads from their sedimentation ponds on the south side of the lake. Levels of total phosphate in the ash lagoon effluent on the north side must not exceed license standards.

- Dust from mine areas, roadways and agricultural lands should be controlled as much as possible.

- Cottage owners should be encouraged to inspect and upgrade faulty septic systems on a voluntary basis. A survey to identify problem areas could form the basis for this encouragement.

- The removal of vegetation and fertilization of lawns and shrubs on lakefront property should be discouraged.

- The importation of sand or soil to improve beaches or replace eroded property, and the alteration of the shoreline as a form of erosion control should be prohibited without its prior investigation and approval by appropriate authorities.

The End Land Use Plan is being undertaken by the County of Parkland, in cooperation with TransAlta Utilities, and its objective is to determine long range land use alternatives after mine reclamation. The plan area includes the mine permit areas plus some adjacent land. It does not deal specifically with the lake shoreline.

TransAlta Utilities, which operates strip mines for thermal coal both to the north (Whitewood Mine) and south (Highvale Mine) of Lake Wabamun, is obligated under the Land Surface Conservation and Reclamation Act to reclaim the disturbed land to a condition equal to

or better than that which existed prior to mining. However, this requirement does not necessarily achieve the highest and best use of the reclaimed land in any given area. The mandate for planning the highest and best future use of the land lies with the County of Parkland, pursuant to the Planning Act. In addition to compliance with these two pieces of legislation, TransAlta also wishes to direct its reclamation activities towards specifically targeted future land uses, in order that restoration of disturbed lands may be carried out in as orderly and cost efficient manner as possible.

In an attempt to satisfy all of these requirements, to avoid potential conficts between them, and to streamline its own reclamation activities, TransAlta has commissioned a study which will result in a long range Land Use Plan for the Whitewood Mine. Funding for the production of the Plan (which includes computer analysis of land capability and suitability for a wide range of land uses, and is based upon input from several consultants in various fields of expertise) has been provided by TransAlta; once the Plan, with its associated maps and supporting documents, has been completed, and the recommendations are acceptable to TransAlta, the Development and Reclamation Committee (responsible for the administration of the Land Surface Conservation and Reclamation Act) and to the County of Parkland, it will be the responsibility of the County to take the Plan through a series of public forums, finally enacting the Plan as Land Use Bylaws. At present, the Plan is nearing completion and will be ready for scrutiny and criticism by TransAlta and the appointed Review Committee by the end of June 1983.

5.4.1.1 References

Mitchell, Patricia, 1981. Lake Wabamun Eutrophication Study; Interim Report; Water Quality Control Branch, Pollution Control Division, Alberta Environment.

Mitchell, Patricia, 1983. Lake Wabamun Eutrophication Study, Preliminary Conclusions and Recommendations, Water Quality Control Branch, Pollution Control Division, Alberta Environment.

Habgood, Helen, 1983. Lake Wabamun Literature Review. Prepared for Lake Wabamun Watershed Advisory Committee.

Lac La Nonne: Background Information and Management Issues, 1980; Plan Alternatives, 1981; Management Study, 1981. Edmonton Regional Planning Commission.

Lac Ste. Anne Management Plan, 1981. Lake Management Plans Section, Regional Planning and Research Division, Edmonton Regional Planning Commission.

Lake Isle: Background Information and Management Issues, 1980; Edmonton Regional Planning Commission; Plan Alternatives, 1982; Management Study, 1983. Edmonton Metropolitan and Yellowhead Regional Planning Commissions.

Nakamun Lake: Options for a Management Direction, 1979; Management Plan Alternatives, 1980. Edmonton Regional Planning Commission.

The Pigeon Lake Study, 1975. Report of the Pigeon Lake Study Group to the Edmonton and Battle River Regional Planning Commissions.

Sandy Lake: Background Information and Management Philosophy, 1979; Management Plan Alternatives, 1980. Edmonton Regional Planning Commission.

Wabamun Lake Management Plan, Phase One - Information Collection and Preliminary Evaluation, 1983. Prepared for Yellowhead Regional Planning Commission. Pedology Consultants and R.S.D. Canadian Geographics Ltd.

5.4.2 Conclusions

The committee strongly supported the Yellowhead Regional Planning Commission's application to the Alberta Planning Board for funding to complete a comprehensive "Lake Wabamun Management Plan" covering both land use and water surface use. Such a plan would also deal with several of the issues listed in Section 4 of this report (see 5.5.2 and 5.6.2). The committee also endorsed the ongoing "End Land Use

Plan" being developed by the County of Parkland in conjunction with TransAlta Utilities. This plan would determine the post-mining land use of the permit areas and would complement the Lake Wabamun Management Plan.

5.5 RECREATION

5.5.1 Background Information

During one of its earliest meetings, the committee received a presentation from Alberta Recreation and Parks entitled "The Regional Significance of Wabamun Lake as a Recreational Resource." This paper provided an excellent overview of the current use of Wabamun and is a good base for further planning. The report consolidated existing information on recreational aspects of Wabamun Lake and addressed its regional importance as a recreation resource.

About 90% of the Wabamun Lake drainage basin consists of cultivated grazing and forested land. The remaining 10% is made up of urban and industrial uses, surface mining, road allowances and lake areas. (e.g. the Village of Wabamun, the Summer Village of Seba Beach and TransAlta Utilities generating plants.

All of the existing Canada Land Inventory Class Two shorelines have been utilized, while 1/3 of the Class Three and 4/5 of the Class Four shoreline remain. Much of the north shore capability is restricted due to the proximity of the CNR railway.

Some recreation potential exists on shorelines within the boundaries of the Wabamun Lake Indian Reserve, areas along the North Shore and to the west, in the Jackpine Grazing Reserve.

Recreation facilities around Wabamun Lake range from private to public. Wabamun Lake Provincial Park is the major public recreation

facility. The lake is used extensively by cottagers and recent assessment records indicate a total of 1,513 developed lots.

There are many diverse groups using the lake and its associated land base. Group camps are common. These cater mainly to youth groups emphasizing environmental education and outdoor skills. Four sailing clubs exist and weekend activities include racing. Recreational fishing is popular with anglers taking up to 68,036 kg (150,000 lbs).

Regional population figures indicate a current potential demand of 638,328 individuals within a 97 km (60 miles) radius of the lake projected to 1,089,000 by the year 2001. User statistics for Wabamun Lake Provincial Park indicate it ranked 8th in 1980 for camping permit sales out of a total of 59 provincial parks and 3rd in the Alberta General Survey for most visited parks. Regionally, only Miquelon Provincial Park recorded more camping parties in both 1979 and 1980. Approximately 93% of the park users came from within a 97 km (60 miles) radius of Wabamun Lake and 81.9% of the users came from Edmonton.

5.5.1.1 References

Regional Significance of Wabamun Lake as a Recreational Resource, April 1981. Planning Branch, Alberta Recreation and Parks.

5.5.2 Conclusion

With the commitment of the Alberta Planning Board to initiate a lake management plan, it was felt that the issue of recreation could more appropriately be handled in that context and, as such, the matter was referred to them.

5.6 FISH AND WILDLIFE

5.6.1 Background Information

Due to its proximity to Edmonton, the fisheries resources of Wabamun Lake have generated considerable interest and concern among user groups. The important fish species are lake whitefish and northern pike, while yellow perch are of minor significance. (Prior to 1912, walleye (pickerel) were present in Wabamun Lake. The cause for their disappearance is not known.) The utilization of the fisheries resource is somewhat unique in that the lake whitefish is a prime target species for both the commercial and the sport fishery.

Commercial fishing in Wabamun Lake was known to have occurred since 1917; however, accurate records of production are available only since 1944. During the period 1944 to 1954, commercial production remained relatively stable. In 1955, a record harvest of over 453,500 kg (1,000,000 lbs.) was recorded. Subsequent to that high level of harvest, the yield decreased drastically forcing a closure of the lake to commercial fishing for the period 1961 to 1964. In 1972, the increased popularity of sport fishing necessitated the allocation of individual quota to each user group. Historical commercial harvest indicated that the total annual production of lake whitefish from Wabamun Lake should be approximately 113,375 kg (250,000 lbs.)

During the period 1972-1975, a significant increase in the population level of lake whitefish stimulated an increase in the number of commercial licences. Since licence limitation in the commercial fishery was (and is) not possible with existing regulations, the commercial harvest exceeded the established quota. To attempt to align harvest with the quota, the length of season of the commercial fishery was reduced from 4 days in 1975 to 2 in 1976 and, finally, to 1 day in 1977.

5.6.1.1 References

Zelt, K.A., 1981. Wabamun Lake - A Fisheries Review. Fish & Wildlife Division, Alberta Energy and Natural Resources.

5.6.2 Conclusion

Future fisheries management strategy for Wabamun Lake must recognize the importance of this lake to the sport fishery opportunities for the angler population of the Edmonton area. With the projected increase in urban population, the utilization of the fisheries resources will continue to increase. This increased demand will necessitate the re-evaluation of the commercial fishery. Furthermore, to broaden the resource base of the sport fishery, the feasibility of re-introducing walleye to Wabamun Lake should be examined.

The committee did acknowledge that the fisheries could suffer with indiscriminate weed harvesting. As such, it was agreed that any expansion of the weed harvesting program would require input from the provincial Director of Fisheries.

The issues raised in the committee meetings in this category included the protection of fisheries and wildlife habitat. Since these matters were directly related to land use planning and zoning, they were referred to the Yellowhead Regional Planning Commission for inclusion in the lake management plan.

5.7 OTHER (FUTURE) CONCERNS

5.7.1 Alternate Cooling Facilities Effects

In the process of carrying out its mandate, the committee spent time

reviewing the ERCB report in relation to alternative cooling facilities for the Wabamun generating plant. Subsequently, the committee endorsed the May 1981 decision of the Energy Resources Conservation Board which stated:

"Although other types of weeds are present in the lake, the Board accepted that Elodea has been the main weed problem in Lake Wabamun and that its establishment in the lake was materially aided by thermal discharge into the lake.

The Board notes that the annual operating capital and maintenance costs for each alternative cooling facility would be relatively high and the effectiveness of these alternatives to control nuisance weed problems in the lake is uncertain. The Board agrees with the interveners that the construction of any of the cooling alternatives would have a significant adverse impact on the area residents and cottagers. Both the applicant and most interveners opposed the construction of any cooling alternatives in favour of the status quo, but with an improved weed harvesting program by Calgary Power. The Board concluded that alternative cooling facilities were not warranted.

The Board believes that mechanical harvesting of weeds since 1972 has been reasonably successful in alleviating interference with recreational uses of the lake and concludes that the most appropriate course of action at this time would be an expanded weed harvesting program by Calgary Power.

The Board is, therefore, prepared, subject to the approval of the Minister of the Environment with respect to environmental matters, and with the authorization of the Lieutenant Governor in Council, to amend Approval No. HE 7606, to allow continued operation of the Wabamun Power Plant on the lake and to order Calgary Power to carry out an expanded weed harvesting program."

5.7.2 Acid Rain

A presentation was also made by Dr. B. Hammond on the issue of acid rain. To address this major concern, Alberta Environment and local industry have formed a steering committee on acid gases in the environment. Under Phase One of this program, water quality chemistry data is being assessed for its relevance to aquatic sensitivity mapping for Alberta. It was pointed out that the nature of Lake Wabamun was such that it had a high buffering capability and that the coal being mined had a very low sulphur content. Given this, the committee agreed that acid rain did not appear to be a problem for Lake Wabamun in the foreseeable future.

6. RECOMMENDED ACTION PRIORITIES

As a concluding exercise, the committee re-examined the recommendations that they had made and, in that review process, they also ranked them. The committee's first recommendation is that the Minister of Environment:

Firstly: **Establish an expanded weed harvesting program in selected areas of Lake Wabamun on a user pay basis as well as an Authority to oversee this program (see Section 5.1.5.6).**

Weed growth has been a continuing issue among lake users for many years and, given the nature of the lake, it is likely to remain one. The harvesting program is a cosmetic solution which, in order to be effective, should be complemented with a lake management plan. The committee therefore recommends:

Secondly: **Preparation and implementation of a lake management plan covering future land use and development as well as water surface use (see Section 5.4.2).**

This plan, while addressing future land use and development, will aid in the long term solution to water quality and the plan will also support land use practices.

The issue of the lake levels has been a high priority among lake users in recent years. The committee is encouraged by the work undertaken by Alberta Environment and Alberta Recreation and Parks to rectify the immediate problem. The committee recommends:

Thirdly: **Encourages the completion of the lake level study currently being undertaken by Alberta Environment and taking appropriate action (see Section 5.3).**

During the committee's deliberations, a number of innovative approaches to weed control were raised. To ensure that other potential solutions are reviewed, the committee recommends that the Alberta Government:

Fourthly: **Examine the potential of utilizing the white amur as a method of controlling weeds (see Section 5.1.4.3).**

The key factor in maintaining lake quality is land use practises by all users. Since public and private activities on the watershed (i.e. sewage disposal into the lakes, lawn fertilization, etc.) can influence water quality, the committee would strongly encourage the Minister of Environment to:

Fifthly: **Develop an information program in conjunction with lake user groups (e.g. Alberta Association of Summer Villages) on the nature of Alberta lakes and how the public can assist in maintaining Water Quality (see Section 2.4.10).**

This program would have a lasting province-wide effect for future generations to enjoy our Alberta lakes.

Many suggestions have been made as to the use of herbicides. These have a potential as a solution but requires more research. Therefore, the committee recommends:

Sixthly: **That the Department examine the potential of herbicides as a method of controlling weed growth (see Section 5.1.2.2).**

This may provide an additional insight to deal with weed problems.

The committee requests the Minister of Environment to:

Seventh: **Refer committee recommendations on Septic Systems and Sewage Disposal (see Section 5.2.1.2), as well as Lake Bottom Treatments (see Section 5.1.3.2), to the appropriate municipalities and government agencies surrounding the lake for further action.**

While the above recommendations are ranked in order of priority, the committee wishes to stress that all would make a significant contribution to improving the use of Lake Wabamun as a recreational resource. In addition, the results of the above will also provide valuable insights into maximizing the use of all Alberta lakes as recreational resources.

GLOSSARY

benthic - organisms living on a solid surface
bloom - a sudden increase in a population in the plankton
chironomids - bottom-living larvae of a fly
epipelic algae - algae growing on sediment
epiphytic - organisms living on plants
eutrophic - nutrient-rich
invertebrates - animals without backbones
littoral - shore region
macrophytes - large (non-microscopic) plants
pharyngeal teeth - teeth lining the inside of the mouth
plankton - organisms living in the free water
phytoplankton - plants (algae) living in the free water
senescence - process of aging
zoobenthos - animals living on the bottom
zooplankton - invertebrate animals living in the free water

APPENDIX I

LITERATURE REVIEW

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LITERATURE REVIEW

EXECUTIVE SUMMARY

Lake Wabamun is one of Alberta's most heavily used recreational lakes due to its size, proximity to Edmonton and relatively good water quality.

TransAlta Utilities Corp. Ltd. operates two electrical generating plants near the lake, fueled by coal from local surface mines. The Wabamun plant uses lake water in a once-through cooling system, discharging the cooling water at 10° to 15°C above ambient lake temperatures into a shallow bay. The newer Sundance plant originally used the same type of cooling system, but in late 1975 switched to a cooling pond independent of the lake.

Within the last 20 years, complaints by cottagers and other lake users of increasing growths of submerged macrophytes have resulted in numerous studies of the lake, mainly regarding the effects of the thermal discharge on submerged macrophytes and other biota.

The heated water indirectly stimulates aquatic macrophyte growth in the discharge area by maintaining an ice-free area which allows winter light penetration and gives plants an earlier start in the spring. The thermal effluent was responsible for a macrophyte species change to dominance by *Elodea canadensis*. *Elodea* had not been recorded in the lake prior to 1968; by the early 1970's, it was a major nuisance. The thermal discharge created environmental conditions whereby *Elodea*, which would normally be at the northern limit of its range in Lake Wabamun, was able to outcompete native species by continuing growth throughout the winter in the ice-free areas. However, in the late 1970's, most *Elodea* populations declined dramatically for unknown reasons. One disputed hypothesis is that the plant itself depleted iron in the sediments to levels that it cannot survive. One major *Elodea* population remains in the power plant discharge area, and the other native macrophyte species continue to be a nuisance throughout the lake.

The Energy Resources Conservation Board required TransAlta to investigate the effect of the thermal discharge on weed growth and the feasibility, cost and effectiveness of various alternative cooling facilities. TransAlta presently conducts an annual program of cutting and removing weeds in the discharge area which is locally effective in alleviating the nuisance. Consultants' reports suggest that an expanded weed harvesting program would be cheaper and have more predictable results than alternative cooling facilities. Alternative cooling facilities such as cooling towers or spray nodules are not guaranteed to reduce the weed problem, and the associated construction activities might actually worsen the situation. Herbiciding may be effective but to date has been done only experimentally on a small scale; effects of large scale application are unknown. In 1981, the ERCB ruled that alternative cooling facilities were unwarranted at the Wabamun plant and ordered TransAlta to expand the weed harvesting program.

In general, effects of the thermal effluent on vascular plants and other biota are to stimulate production and, in some cases, to alter species composition. Organisms living within the thermal plume area are subject to wide daily temperature fluctuations and higher than ambient temperatures to which some species have a better tolerance than others.

Algal growth continues throughout the winter in the ice-free discharge area, whereas growth is restricted under ice. The discharge does not change species composition of planktonic algae except within the discharge canal itself where blue-green abundance is greater and the number of diatom species is reduced. Species composition of epiphytic algae (algae attached to Scirpus stems) is altered in the heated area. Within the discharge area the summer phytoplankton standing crop is reduced due to shading from the abundant macrophytes.

Rotifers, which dominate the zooplankton from early spring to mid-July, produce eggs at an increased rate in the heated area; water temperatures greater than 22.4°C may be detrimental to them.

Within the thermal effluent zone, the zoobenthos is characteristic of a higher degree of eutrophication than elsewhere in the lake. Species diversity is lower within the discharge canal.

Weed cutting reduces the numbers of those animals associated with the vegetation, although other species increase following cutting. Herbicide is detrimental to zooplankton.

The lake supports a number of fish species, of which lake whitefish is the most important commercially and recreationally. The population is normally characterized by fluctuations, which were perhaps emphasized by over-fishing. Present management strategy emphasizes sport over commercial fishing. The Sundance thermal effluent, before it was eliminated from the lake, was thought to threaten important whitefish spawning area. The effluent caused increased egg mortality, accelerated egg development and too-early hatching. The construction of the Sundance cooling pond eliminated some pike spawning area but did not harm the population. Weed cutting, if done too early in the season, is detrimental to pike fry which cling to vegetation for about one week after hatching.

Water quality in Lake Wabamun is quite good compared with other lakes in the area. Unlike many central Alberta lakes, blue-green algal blooms rarely occur in Wabamun. Its trophic state is mildy eutrophic. It is well-oxygentated and winter anoxia is usually not a problem. The thermal effluent does not alter the water chemistry. Because of its shallowness and orientation to the wind, the lake is well mixed and permanent summer thermal stratification does not cocur.

Quantitative water and nutrient budgets have not yet been established. The lake has no major inflow or outflow streams and is under an evaporative regime. The lake level fluctuates but enhanced evaporation from the thermal discharge has not caused an overall decline. Groundwater is an important recharge source, with the coal units supplying most of the recharge water. Overland runoff of precipitation is the major nutrient contributor, with

other sources being direct precipitation, mine drainage and cottages. The contribution of sewage leakage from cottage septic systems is unknown but probably quite small. Bottom sediments are very thick, loose and stirred up, and probably represent a very large nutrient store. They contain significant amounts of biologically available phosphorus and may release phosphorus to the water.

At present, the major ongoing research at Lake Wabamun is a provincial government nutrient study which focuses on defining nutrient loading sources and determining whether nutrient control would be feasible and effective in maintaining present water quality.

SUMMARY

A. INTRODUCTION

1. The purpose of this report is to review all scientific literature pertaining to Lake Wabamun.

2. Lake Wabamun is an important recreational and industrial resource; developments include numerous summer cottages and subdivisions, five summer villages, a provincial park and two coal-fired power plants operated by TransAlta Utilities Ltd.

3. The lake is a typical shallow productive prairie lake supporting dense summer growths of aquatic macrophytes which are a nuisance to recreationists.

4. In 1973, the Energy Resources Conservation Board (ERCB) required TransAlta to determine if the power plant thermal effluent contributed to weed growth in the lake, and to investigate alternate cooling facilities.

B. BACKGROUND

1. Paleolimnological evidence indicates that Lake Wabamun has always been productive since glacial retreat about 10,000 years ago.

2. Bedrock north, south and west of the lake is the Paskapoo Formation, which contains mineable coal; east of the lake it is the Edmonton Group which underlies the Paskapoo.

3. Topography has been modified by continental glaciation; the lake was probably formed by glacial ice-thrusting. Surficial deposits are of glacial origin.

4. Soils are mainly of the Gray Wooded type and have limitations for agriculture.

5. The lake level fluctuates considerably; enhanced evaporation due to power plant operation has not caused a decline in lake level as was once feared.

C. HUMAN USE

1. Lake Wabamun has been used for recreation since the early 1900's.

2. Wabamun village is the main permanent population centre. There are five summer villages and numerous cottage subdivisions around the lake as well as several camps and yacht clubs.

3. Wabamun village has a secondary treatment sewage lagoon with discharge to the Lac Ste Anne watershed. Other residences use individual septic systems or pit privies.

4. Wabamun Lake Provincial Park is the only major public recreation facility.

5. Sport fishing has become a more important activity than commercial fishing; winter ice-fishing is more popular than summer fishing.

D. POWER GENERATION

1. The Wabamun thermal plant on the north shore, commissioned in 1956 and with a present capacity of 569 MW, uses lake water in a once-through cooling system, discharging heated effluent water at 10° to 15°C above ambient lake temperatures into shallow Kapasiwin Bay.

2. The Sundance plant on the south shore, commissioned in 1970 and with a present capacity of 2100 MW, has used a cooling pond independent of the lake since late 1975.

3. The thermal effluent water keeps an ice-free area in the winter.

E. PHYSICAL AND CHEMICAL CHARACTERISTICS

1. The normal temperature regime of the lake is winter ice cover and inverse stratification; complete wind mixing and fairly isothermal conditions prevail in spring, summer and fall; permanent summer stratification does not occur. Temperatures range from 0°C to over 20°.

2. The thermal discharge plume forms a thin surface layer over the ambient water; temperature patterns in the plume area vary with wind.

3. Dissolved oxygen is ample throughout the year and oxygen is usually present to the bottom. Surface water is usually oxygen saturated; in the plume it is supersaturated.

4. Wind mixing and internal currents keep water quality quite consistent throughout the lake.

5. Bottom sediments are very thick; the upper sediments are loose and unconsolidated. Sediments contain significant amounts of biologically available phosphorus.

6. Lake Wabamun water quality compares favourably with other Alberta lakes. Its trophic status is mesotrophic to moderately eutrophic.

7. The lake is under an evaporative regime. Surface inflow and outflow are relatively minor. Groundwater recharge, mainly from the coal units north of the lake, is probably important. The direction of groundwater flow is from northwest to southeast.

8. Although a quantitative nutrient budget has not yet been determined, phosphorus appears to be the limiting nutrient. Major sources of phosphous input are surface runoff, ash lagoon effluent, precipitation and sediment recycling. Sewage makes only a minor contribution; groundwater is unknown.

F. LAKE BIOTA

1. The phytoplankton species composition and abundance are characteristic of a meso-eutrophic state; blue-green algal blooms rarely occur.

2. The thermal effluent indirectly causes increased algal prooduction by maintaining an ice free area where light can penetrate, thus extending the growing season through the winter. Summer phytoplankton production is reduced in the discharge area due to shading from dense macrophytes.

3. Phytoplankton species composition is not altered by the thermal effluent.

4. Epipelic (free-living benthic) algal standing crop is increased in the discharge area due to increased winter light.

5. The plant outlet canal supports a large crop of filamentous and blue-green algae.

6. Benthic diatoms are little affected by the thermal effluent except within the outlet canal where species diversity is reduced.

7. Epiphytic algae (algal attached to submerged surfaces) show increased standing crop and reduced species diversity in the discharge area. The growing season for both algae and its substrate (emergent macrophytes) is extended.

8. Rotifers, which dominate the zooplankton community in spring and early summer, exhibit accelerated egg production in the effluent area. Eggs are less tolerant of elevated temperature than adults.

9. Species composition, but not biomass, of crustaceans, which dominate the zooplankton after mid-July, is altered in the effluent area.

10. Species composition of the benthic fauna is characteristic of a greater degree of eutrophication in the discharge area than elsewhere in the lake. This is mainly an indirect effect due to enhanced trophic status of the sediments because of abundant decomposing macrophytes.

11. Thermal enrichment causes accelerated egg development and growth in the snail Physa gyrina, permitting year round reproduction. Snail parasite transmission is also enhanced.

12. Whitefish and pike populations have fluctuated over the years and have at times suffered from overfishing.

13. Thermal effluent may be detrimental to whitefish spawning; the Sundance plume (now eliminated) threatened an important spawning area.

14. Fish kills, although rare, have been documented, due to "cold shock" and deoxygenation in Goosequill Bay.

G. AQUATIC MACROPHYTES

1. Aquatic macrophytes, abundant in shallow areas especially at the east end of the lake, are a nuisance to lake users.

2. Since 1968, a species change from Myriophyllum - Chara to Elodea has been documented. Elodea became a major nuisance in the early to mid-1970's.

3. A cause-effect relationship between thermal discharge and excessive weed growth has been investigated.

4. Sediment type and exposure to wind and waves are important determinants of plant species distribution. Local instability and high turnover rates are normal conditions of the aquatic macrophyte communities.

5. Elodea, rare in Alberta and not documented in Lake Wabamun prior to 1968, dramatically increased as an indirect result of the thermal discharge. Elodea, which does not become dormant in winter, was able to continue growth throughout the winter in the ice-free area, outcompeting native species which become dormant despite the greater light availability in the discharge area.

6. Within only a few years, most Elodea populations declined substantially; only the one at the Wabamun plant outlet remains vigorous. One disputed theory to explain the decline is sediment iron depletion by the plant.

H. CONTROL OF AQUATIC MACROPHYTES

1. Methods that might control symptoms of the macrophyte nuisance include weed harvesting, herbiciding, bottom barriers, dredging, dilution and flushing, grazing, pathogens, competition, shading, water level manipulation and nutrient limitation.

2. Of these, weed harvesting and herbiciding offer the best results with reasonable cost.

3. Weed harvesting has been done by TransAlta since 1972; it is quite effective but must be repeated annually.

4. Weed harvesting may be detrimental to some invertebrates and small fish. Certain guidelines help to alleviate harmful effects.

5. Although herbiciding can be effective, effects of large scale application are unknown.

6. The thermal effluent has a localized effect on macrophyte growth and indirectly caused a species shift to Elodea; it does not affect the whole lake.

7. Alternate cooling schemes for the Wabamun plant have been studied; most would be very expensive, probably would not alleviate the problem and some would have major negative impacts. Elimination of the Sundance discharge did not reduce the weed problem in that area.

8. In 1981, the ERCB ruled that alternate cooling facilities for the Wabamun plant were unwarranted and required TransAlta to expand the weed harvesting program.

9. An abundant nutrient supply is more likely the cause of abundant macrophyte growth. Uncontrollable nutrient contributors are precipitation and bottom sediments. Nutrient sources where some control may be feasible are streams, flyash lagoon effluent and sewage. Nutrient budget and nutrient control feasibility are now being studied.

APPENDIX 2

THE LAKE WABAMUN EUTROPHICATION STUDY

PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

Prepared by:

Patricia Mitchell
Biologist

Water Quality Control Branch
Pollution Control Division
Alberta Environment

March 28, 1983

INTRODUCTION

In response to public concern over nuisance plant growth in Lake Wabamun, the Water Quality Control Branch of Alberta Environment began the Lake Wabamun Eutrophication Study in 1979. Since problems with excessive plant growth are usually a result of abundant plant nutrients, the study involved measuring or estimating nutrient supplies from all sources. An additional goal was to determine possibilities for reducing these supplies to at least maintain the present quality of the lake. The study focused on the major plant nutrient phosphorus (as total phosphorus), since it was established early in the study that it was the limiting nutrient: Its reduction should theoretically reduce plant populations in time.

CONCLUSIONS OF THE STUDY

Streams and Diffuse Watershed Areas

1. The most important external source of phosphorus to Lake Wabamun is the soil in its surrounding watershed. Any disturbance of the land surface, including clearing, increases the export of phosphorus from that land.

2. The export of phosphorus from forested areas was lower than that for disturbed areas. An undisturbed or "natural" watershed for Lake Wabamun can be estimated by extrapolating data from forested streams to the entire watershed. The resulting total phosphorus supply is only 20 to 30% less than the supply actually measured in 1980 and 1981.

3. Although large streams contribute more phosphorus than small streams, there are no "point sources" contributing excessive quantities relative to other streams.

Coal Mine Areas

4. Mine drainage from the pits on the south side and through the licenced

ash lagoon accounted for 21% of the total external supply of phosphorus during the study. More than half of this supply was in a dissolved form, even though suspended sediment levels were high.

Bulk Precipitation

5. Precipitation, including dust, is the second largest contributor of phosphorus to the lake. Over half of the annual phosphorus supply entered the lake in June, July and August in 1980 and 1981, whereas winter supplies were low.

Shoreline Cottages

6. Effluent from cottage septic fields appeared to contribute 1% or less of the total phosphorus supply to the lake.

7. Because cottages are located very close to the edge of the lake, nutrients from cottaging activities may stimulate plant growth in localized areas, even though the remainder of the lake would not be measurably affected.

Estimate Sources

8. It is probable that groundwater is not an important source of phosphorus to the lake.

9. The sediments appeared to play an important role in recycling phosphorus, especially in late summer when external supplies were low. The estimated annual quantity of phosphorus derived from the sediments exceeded all external inputs combined in 1980 and 1981.

APPROACHES TO CONTROL NUTRIENTS

Lake Wabamun is reported to be the best studied lake in the province. But

no previous study provides reliable nutrient data to compare with present values, so there is no way to measure change. Cores of the bottom sediments in Lake Wabamun show that the lake has been productive for at least 4000 years - and macrophytes undoubtedly have been a part of the lake environment throughout its history. However, the cores do not provide information on whether the lake has changed over the past 50 to 100 years. Human activity in the watershed probably has increased the supply of nutrients to the lake over this period.

There are three possible scenarios for dealing with the situation:

1. We can assume that there is no trend toward increasing productivity, and that the perceived deterioration is a combination of climatic cycles and the tendency of people to remember the best conditions in their past. In this case, the solution is to do nothing.

2. We can assume that the lake is deteriorating rapidly and all possible measures, at any cost, must be implemented immediately to save the lake.

3. We can attempt to reduce nutrient export from the watershed using low cost, preventative or clean-up measures, largely on an individual, voluntary basis.

The first scenario is the simplest, but may be the most costly in the long run. "It is safer and generally more economical to take early preventative measures for controlling eutrophication than to develop curative strategies later when water quality has already deteriorated".[1]

The second scenario involves major projects such as lagooning creeks for phosphorus control treatment, dredging, whole-lake chemical treatment, or flushing. Results of the Eutrophication Study suggest:

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1. R.A. Vollenweider, Chairman, OECD International Cooperative Programme on Eutrophication and Monitoring of Inland Waters, 1980.

a. the lake is not in an advanced state of eutrophication;

b. much of the external supply of phosphorus is from natural sources;

c. sediment recycling may compensate for external phosphorus load reduction for many years.

The risks and dubious benefits probably do not warrant the high costs for such projects.

The third scenario requires a great deal of citizen responsibility and participation. Its drawback is that there likely would be no visible results in terms of improved water quality or reduced weed populations. Even if water quality should improve, i.e. levels of phosphorus and chlorophyll in the water decrease, macrophyte populations may increase because of greater water clarity. However, it is the recommended approach as a relatively low cost way to control nutrient inputs and thereby maintain water quality in Lake Wabamun. The following recommendations are based on data analysis to the present time:

RECOMMENDATIONS

1. Landowners within the watershed should be encouraged to improve land management practises to minimize nutrient export on a low cost voluntary basis. A survey to identify problem areas could form the basis for this encouragement.

2. Nutrient control measures should be required for all new construction, road building, resource extraction, or other projects which disturb the land surface.

3. TransAlta Utilities should reduce sediment and phosphorus loads from their sedimentation ponds on the south side of the lake. Levels of total phosphate in the ash lagoon effluent on the north side must not

exceed license standards.

4. Dust from mine areas, roadways and agricultural lands should be controlled as much as possible.

5. Cottage owners should be encouraged to inspect and upgrade faulty septic systems on a voluntary basis. A survey to identify problem areas could form the basis for this encouragement.

6. The removal of vegetation and fertilization of lawns and shrubs on lakefront property should be discouraged.

7. The importation of sand or soil to improve beaches or replace eroded property, and the alteration of the shoreline as a form of erosion control should be prohibited without its prior investigation and approval by appropriate authorities.

APPENDIX 3

SUMMARY OF COMMITTEE MEETINGS

LAKE WABAMUN WATERSHED ADVISORY COMMITTEE

SUMMARY OF ACTIVITIES

Meeting #1 - January 28, 1981

1. Review of Terms of Reference

Meeting #2 - February 24, 1981

1. Information: professional presentations

   a. Dr. Paul Gorham and Dr. Dale Allen, Botany Department, University of Alberta
      - lake ecology

   b. Patricia Mitchell, Alberta Environment
      - eutrophication study

   c. Janice Crosby, Alberta Environment
      - Beak Consultant's report

Meeting #3 - March 24, 1981

1. Information: professional presentations

   a. Trefor Reynoldson, Alberta Environment
      - whole lake dredging, North Saskatchewan River diversion

   b. Courtenay Breckenridge, County of Parkland
      - End Land Use Plan

   c. Wes Shennan, Edmonton Regional Planning Commission
      - lake management plans

   d. Bob Rempel, Alberta Environment
      - public participation

2. Committee newsletter development

3. Committee supports ERPC's application to Alberta Planning Board for Lake Wabamun Management Plan

Meeting #4 - April 30, 1981

1. Committee members presentations: concerns and problems relating to Lake Wabamun

2. Ken Zelt, Alberta Fish & Wildlife
   - Presentation - Fisheries in Lake Wabamun

Meeting #5 - May 26, 1981

1. List of concerns discussed.

Meeting #6 - June 23, 1981

1. Information: presentation by William Drager, cottage owner.
   - Expressed concern over high lake level and described problems encountered by Fish and Wildlife in gaining access to remove beaver dams on Indian reserve that are blocking outlet creek.

2. Request for assistance in locating groundwater test well sites from Don Prosser, Alberta Environment, Groundwater Branch.
   Several committee members contacted landowners.

3. Committee recommended that the Lake Wabamun watershed should not be deleted from the ERPC with regard to lake management plan, in light of ERPC boundary changes.

4. Committee agreed with ERCB decision of May 1981 that alternate cooling facilities at Wabamun are unwarranted and that TransAlta shall expand weed harvesting.

5. List of concerns agreed upon.

July 21, 1981 - Committee Presentation to Wabamun Sailing Club

Meeting #7 - August 24, 1981

1. Lake tour: firsthand look at weed problems, high water damage, eutrophication study activities, thermal discharge.

Meeting #8 - September 19, 1981 - Public Meeting in Wabamun

1. Presentations by:

   a. LWWAC (C. Weir)

   b. County of Parkland End Land Use Plan (C. Breckenridge)

   c. Alberta Environment Eutrophication Study (Pat Mitchell)

2. Expression of public concerns:

   a. Weed growth

   b. Water quality (especially discharge of sewage)

   c. Lake level

October 21, 1981 - Meeting with Alberta Planning Board
Re: Lake Wabamun Management Plan

1. Both groups agreed on need for plan.

2. Alberta Planning Board will develop mechanism to begin work on plan without undue delay.

Meeting #9 - October 27, 1981

1. Committee recommends development of Lake Wabamun Management Plan as soon as possible.

2. Public Presentation: Curtis Hansford, Seba Resident
   - Personal recollections of weeds, lake levels.

3. Discussion of eutrophication study interim report; Committee expressed appreciation for information provided.

4. Discussion of sewage survey.

5. Discussion of progress report.

Meeting #10 - November 24, 1981

1. Interim report prepared.

   Committee recommends:

   - require marinas, yacht clubs and trailer parks to provide sewage disposal facilities for boats, cars and campers;
   - require licensing of septic tank pumpout trucks;
   - keep Wabamun Creek free-flowing by beaver control;
   - extend committee to December 31, 1983.

2. Committee commends federal decision to replace Wabamun wharf.

Meeting #11 - January 12, 1982

1. Committee recommends to Federal Department of Fisheries and Oceans that the new wharf at Wabamun be built to accommodate keel boats.

2. Discussion of an expanded weed harvesting program.

Meeting #12 - March 31, 1982

1. Position papers on herbicides, lake bottom treatments, sediment dredging and flushing and dilution discussed.

2. Presentation by Mr. B. Purdy of TransAlta Utilities on the current weed harvesting operation.

Meeting #13 - April 27, 1982

1. Continued discussion of TransAlta's Weed Harvesting Program.

2. Recommendations made in regard to:

   - Sediment Dredging
   - Herbiciding

3. Presentation by Mr. G. Warwa on the "Root'r", a land based weed harvester.

Meeting #14 - June 10, 1982

1. Recommendations made in regards to:

   - lake bottom treatments

   - flushing and dilution

2. Presentation by Mr. D. Pledger, Pesticide Chemicals Branch, Alberta Environment

3. Update given on Phase One of Lake Management Study.

Meeting #15 - August 19, 1982

1. Lake Tour

   - A helicopter tour of Lake Wabamun and Lake Isle.

   - An update on the eutrophication study.

   - A "hands on" examination of TransAlta's weed harvesting operation.

Meeting #16 - August 28, 1982

1. Public demonstration of eutrophication study at Seba Beach.

2. Public Meeting in Wabamun

   - Presentation by C.H. Weir on the committee's activities to date.

   - Presentation by P. Mitchell on the eutrophication study.

   - Presentation by Dr. Dale Allen on weed growth.

   - Subsequent discussion focussed on lake levels with a motion being passed establishing the 1976 level as the preferred level.

Meeting #17 - September 3, 1982

1. Public meeting reviewed.

2. Discussion on lake levels.

3. Resolution developed requesting Alberta Environment to repair and/or replace the existing control structure so as to stabilize lake levels.

Meeting #18 - October 26, 1982

1. Update given on Lake Management Plan.

2. Update given on the Lake Level Advisory Committee and the water balance study.

3. Discussion on White Amur (weed eating carp).

Meeting #19 - November 24, 1982

1. Presentation by Mr. Whitford, Plumbing Inspection branch re: regulations for septic tanks.

2. Presentation by Mr. A. Masuda, Head Water Quality Control Branch re: sewage discharge problems.

3. Presentation by Pat Mitchell re: eutrophication study.

4. Lengthy discussion on white amur.

Meeting #20 - January 12, 1983

1. Update on Lake Management Plan - Grahame Allen, Yellowhead Regional Planning Commission.

2. Recommendation made in regards to white amur.

3. Report received on questionnaire results.

Meeting #21 - March 1, 1983

1. Report made on sailing clubs' questionnaire.

2. Weed harvesting discussed, in particular, the concept of a weed harvesting authority.

Meeting #22 - March 28, 1983

1. Weed harvesting program reviewed and recommendation made.

2. Report on Sportsman's show.

3. First draft of final report reviewed.

APPENDIX 4

INTERIM REPORT - December 1981

INTERIM REPORT - September 1982

LAKE WABAMUN WATERSHED ADVISORY COMMITTEE

INTERIM REPORT TO THE MINISTER OF ENVIRONMENT

DECEMBER 1, 1981

The Lake Wabamun Watershed Advisory Committee, established by Ministerial Order #127/80 in November 1980, is charged with making recommendations to the Minister of Environment by March 31, 1982 on future land and water management practises for the Lake Wabamun Watershed with the goal of maintenance or improvement of the water quality of Lake Wabamun.

The 14-member committee has held monthly meetings since January 1981. Much of the time has been devoted to information gathering: members have read numerous reports and studies on the lake, have heard presentations from experts and concerned citizens and have toured the lake for a first-hand look at problems.

To date, the committee has taken the following actions:

1. IDENTIFICATION OF CONCERNS:

Based on the information gathered and the experiences of committee members and the groups which they represent, the committee developed the following "list of concerns":

1.1 WEED GROWTH

- Nuisance weed and other aquatic growth
- Weed control measures (mechanical, chemical, biological)

1.2 WATER QUALITY

- Nutrient enrichment and other pollution (domestic, industrial, agricultural)
- Determination of natural condition
- thermal input

1.3 LAKE LEVELS

1.4 LAND USE PRACTISES AND PLANNING

- Coordination of planning, infrastructure and development (residential, recreational, industrial, agricultural)
- Lack of public awareness
- Mining operations and procedures

1.5 RECREATION

- Insufficient public recreation facility areas
- Retention of recreation resource
- Boat regulation and regulation of other lake users

1.6 FISH AND WILDLIFE

- Management and protection of fishery (sport, commercial, Indian)
- Protection of wildlife habitat

1.7 OTHER (FUTURE) CONCERNS

- Acid rain
- Alternate cooling facilities effects
- Ramifications of LWWAC actions for all Alberta recreational lakes
- Air quality
- Energy costs

2. SUPPORT OF LAKE MANAGEMENT PLAN

The committee fully supported the Edmonton Regional Planning Commission's (ERPC) application to the Alberta Planning Board for a Lake Wabamun Management Plan. However, with the recent annexation decision, the ERPC's boundaries were reduced to exclude Wabamun. The committee recommended that work on the Lake Wabamun Management Plan should continue and be completed by the ERPC. The ERPC later decided not to go ahead with the management plan since it would not be able to see it through to completion. In October, the committee met with the Alberta Planning Baord to discuss a management plan and agreed that it should commence as soon as possible. The board agreed to find a mechanism to begin work on the plan without delay and the committee agreed to assist.

3. END LAND USE PLAN

The committee also endorsed and agreed to assist with the ongoing End Land Use Plan being developed by the County of Parkland in conjunction with TransAlta Utilities Ltd., to determine post-mining land use of the mine permit areas. This plan should complement the lake management plan well; ideally, the timing of the two plans should be synchronous.

4. ERCB DECISION

The committee endorsed the May 1981 decision of the Energy Resources Conservation Board which stated that alternate cooling facilities for the Wabamun generating plant are unwarranted and directed TransAlta to expand the weed harvesting program.

5. PUBLIC INPUT

The committee gathered input from concerned members of the public by sponsoring a public meeting in Wabamun on September 19. The meeting was attended by some 60 persons including committee members. The main concerns expressed at this meeting were:

5.1 Weed Growth
5.2 Water Quality (especially sewage discharge)
5.3 Lake Level

The committee also has issued 5 newsletters to date which were mailed to approximately 1400 cottage owners and other lake users. The newsletter has elicited 21 responses in the form of letters and calls from people to express their concerns which were mainly the three items identified at the public meeting.

Taking into consideration the mailing of some 7000 newsletters, a well-advertised public meeting, visitation at the Eutrophication Study Information Trailer of 55 persons and efforts by individual committee members, the input and response from the geenral public has been moderate.

6. EUTROPHICATION STUDY

The ongoing Lake Wabamun Eutrophication Study being conducted by Alberta Environment under the direction of Patricia Mitchell will be a very important scientific information base in the formulation of the committee's final recommendations. Ms. Mitchell has freely given of her time to act as a resource person for the committee on a number of occasions. In October, Ms. Mitchell discussed the recently released eutrophication study interim report, for which the committee expressed its gratitude for the depth, breadth and informative value of the report. The final report of the study is expected in mid-1983.

7. LITERATURE REVIEW

The review of all scientific literature pertaining to Lake Wabamun being compiled by Helen Habgood, the committee's technical assistant, has greatly assisted the committee in the study of the many reports and investigations which have been conducted. The review should be completed by February 1, 1982. The committee expressed its gratitude to Helen Habgood for this valuable work and also the good work she did in preparing the minutes and organizing the venue of the meetings.

8. BUDGET

8.1 The committee to date has spent approximately 60% of the $15,090 budget for general expenses. The majority of this was for remuneration to those members not in the civil service.

8.2 Approximately 40% of the 10,000 public participation budget has been spent.

9. RECOMMENDATIONS

To address concerns identified in Section 1 of this report, the committee makes the following recommendations:

9.1 Concern addressed: WATER QUALITY

Recommendation: Marinas, yacht clubs and lakeshore trailer camps should be required to install or provide sewage disposal facilities for all boats, cars, campers, etc.

The committee urges the Minister to undertake appropriate action to implement this recommendation.

The committee further recommends installation of a public sewage disposal facility for boats at Seba Beach. (See appendix 1.)

9.2 Concern addressed: WATER QUALITY

Recommendation: Operators of septic tank pumpout trucks should be licensed with Provincial Board of Health and/or the County: the license should state specifically where material is to be disposed of (i.e. sewage lagoon), and infractions should be severely prosecuted.

The committee urges the Minister to pass this recommendation on to the appropriate authorities.

The committee also suggests that villages and summer villages utilizing septic tank services should work out group agreements to pump out all tanks at one time to make servicing more economical. (See Appendix 2.)

9.3 Concern addressed: LAKE LEVEL

Recommendation: The committee recommends that the Minister of Environment pass on the concerns about beaver dam blockage on Wabamun Creek to the Hon. J.E. (Bud) Miller, Associate Deputy Minister of Public Lands and Wildlife, Dept. of Energy and Natural Resources, and urge Mr. Miller to take action to reach an ongoing agreement with the Paul Band to keep Wabamun Creek free-flowing. (See Appendix 3.)

9.4 TENURE OF COMMITTEE

Recommendation: The date for the committee's final report should be delayed to December 31, 1983, so that the committee may have the benefit of the findings of the Eutrophication Study, End land Use Plan, Lake Management Plan and literature review, all of which will have a material influence on any recommendations to the Minister. Meanwhile, the committee would continue meeting as necessary. (See Appendix 4.)

9.5 The committee recommends that: The contents of this interim report should be made available to the public.

LAKE WABAMUN WATERSHED ADVISORY COMMITTEE

SECOND INTERIM REPORT TO THE MINISTER OF ENVIRONMENT

SEPTEMBER 9, 1982

The Lake Wabamun Watershed Advisory Committee, established by Ministerial Order #127/80 in November 1980, is charged with making recommendations to the Minister of Environment by March 31, 1983 on future land and water management practises for the Lake Wabamun Watershed with the goal of maintenance or improvement of the water quality of Lake Wabamun.

The 14-member committee held monthly meetings in 1981 and 7 meetings in 1982. Much of the time in 1981 was devoted to information gathering: members have read numerous reports and studies on the lake, have heard presentations from experts and concerned citizens and have toured the lake. The first interim report, dated December 1981, covered our activities in 1981. A copy is attached. During 1982, we have held 7 meetings, including a lake tour and the second public meeting on August 28, 1982.

In 1982, the committee dealt with several proposed solutions to reduce weed growth and improve water quality as follows:

1. FLUSHING & DILUTION

   1. <u>Flushing</u>

      Flushing implies washing out the lake with large volumes of water. The mean monthly flow of both the North Saskatchewan and the Pembina Rivers is below the amounts calculated for a flushing action in Lake Wabamun. Therefore, flushing of Lake Wabamun is not a possibility for water quality improvement or a solution to the weed problem.

   2. <u>Dilution</u>

      Dilution implies increasing the input of clean water into the lake, thus increasing the outflow and reducing the lake water nutrients to the level approaching the levels in the input water. Diversion of water from the North Saskatchewan River and the Pembina River involves a number of factors as follows:

      a. Estimated flow rate required for dilution of Lake Wabamun is in the neighbourhood of 425 cfs.

      b. Rough cost estimates from either river is in the order of $100 million or greater.

c. Dilution may have little effect on the lake water nutrients used by the macrophytes as the North Saskatchewan River water contains higher mean total phosphorous than the lake water and the Pembina River water is similar to lake water.

d. Dilution with river water may have little effect on the weed problem (macrophytes) since lake sediments provide much of the plant nutrient requirements.

e. Siltation from incoming river water would have to be accommodated.

f. Wabamun Creek would need considerable upgrading to handle the outflow.

g. Dilution would require almost the entire Pembina River flow and involve an interbasin transfer of water.

Therefore, dilution of Lake Wabamun with water from nearby rivers is impractical and not a workable solution for improvement of water quality or weed growth.

II. DREDGING OF LAKE SEDIMENTS FOR IMPROVED WATER QUALITY AND WEED CONTROL

Conclusion of the Committee:

Dredging of the sediments of the whole lake is impractical and not a workable solution for water quality improvement.

III. LAKE BOTTOM TREATMENTS

The Committee recommended as follows:

Whereas treatment of the whole lake bottom is not considered to be feasible because of the lake's large size and the prohibitive cost, the committee recommends for the treatment of selected locations:

1. The use of fiberglass screens and/or plastic liners in selected locations to help alleviate local weed problems. This would be applicable around public and private docks, piers and swimming areas.

2. Sand could be used in certain areas to enhance recreation beaches and discourage macrophyte growth.

Despite its abundance at Wabamun, the committee does not recommend the use of flyash as a bottom sealant because of:

1. high content of heavy metals, boron and aluminum;

2. probable development of detrital sediment layer on top of flyash from decomposing macrophyte growth and sediment transport from untreated areas;

3. potential problems of stirring up of flyash by lake currents.

IV. HERBICIDE USE

The Committee made the following recommendations:

1. Large-scale herbicide application should not be used for weed control in Lake Wabamun because of risk of exposure of public and unknown ecological effects.

2. The Department of Environment embark on a program to implement the use of herbicides on a very limited scale in localized areas and with careful monitoring for experimental purposes to determine their effectiveness as a deterrent on undesirable weed growth.

The September 3, 1982 meeting of the committee dealt with the matter of high water levels which is presently a concern of many lake users.

The committee recommended as follows:

WHEREAS Lake Wabamun is one of the most highly used lakes in Alberta and a major Alberta recreation resource;

AND WHEREAS the September 19, 1981 and the August 28, 1982 public meetings expressed concern over high lake levels and the damage caused by the high water;

AND WHEREAS the August 28th public meeting unanimously passed a resolution that a control be established to hold the water levels at the 1976 elevations;

AND WHEREAS the 1976 level agrees with the long time average lake level and the level agreed upon during the 1930's;

AND WHEREAS the Government of the Province of Alberta constructed a weir during the 1930's to control the water level;

AND WHEREAS the Government of the Province of Alberta has in the past conducted similar programs at other lakes;

THEREFORE, be it resolved that a program be developed by Alberta Environment for improving, repairing and/or replacing the existing outlet control structure and outlet channel to stabilize the water level of Lake Wabamun with responsibility to be on a participation basis.

The committee also endorsed and agreed to assist with the ongoing End Land Use Plan being developed by the County of Parkland, in conjunction with TransAlta Utilities Corporation, to determine post-mining land use of the nine permit areas. This plan should complement the Lake Management Plan well. Ideally, the timing of the two plans should be synchronous.

The Committee supported the preparation of a Wabamun Lake Management Plan. Phase One - Information Collection and Preliminary Evaluation is already underway and should be completed at the end of the year. The second phase will be prepared by the recently established Yellowhead Regional Planning Commission and will actively involve all lake users.

The weed harvesting program carried out by TransAlta Utilities appears to have been successful in reducing the weed growth which affected the recreational use of the lake. The committee is now discussing the possibility of an expanded weed harvesting program to be carried out under the auspices of an independent weed control authority. The weed authority, made up of lake user representatives, would oversee a weed harvesting program in selected areas of the lake. The costs are high and vary considerably but are within reach for areas with a severe problem. Costs range from $300 to $600 per acre and are dependent of several factors. Financing of the operation of the authority and the weed harvesting program would be assessed against the lake users in some manner. The committee is continuing to study the matter and will be receiving further input from the public and the experts studying the lake.

September 9, 1982

C.H. Weir, Chairman

APPENDIX 5

POLITICAL, ADMINISTRATIVE AND REGULATORY JURISDICTIONS

Source: Yellowhead Regional
Planning Commission

POLITICAL, ADMINISTRATIVE AND REGULATORY JURISDICTIONS

There are many political, administrative and regulatory jurisdictions that have responsibilities in the study area. The major jurisdictions are:

- Federal Government: policing of the surface of Wabamun Lake;

- Provincial Government: maintenance of environment quality and fish and game management;

- Local Government: subdivision approval authority plus local bylaws; and

- Yellowhead Regional Planning Commission: input into subdivision approval and land use planning.

To assist the reader in locating the proper jurisdiction involved, a preliminary list of the various areas of concern have been summarized below.

Outlined are areas of potential concern, questions or information requests which may occur relative to future management directions for Wabamun Lake. Utilizing an index system, various political, administrative and regulatory agencies have been cross-referenced to the areas of potential interest so that initial inquiries can be directed to the appropriate agencies.

Preliminary List

Areas of Concern	Initial Contact Agencies
agricultural practises	10
archaeological issues	5,9
blockage of lake outlet channel	1,15
boating restrictions	14,2,9
building construction	1,2,3,4,5,6,7,8,9
clearing of offshore weeds	17,19,22
coal mining activities	23,25
commercial bathing areas, piers and wharfs	2,7,9
development permits	1,2,3,4,5,6,7,8
docks, boatlifts, boathouses	2,7,11
drinking water quality	12
fish and wildlife management	15,22
fish habitat protection	22
fluctuating lake levels	20,21
lake water quality/pollution	18
lake water withdrawal	19,20,21
land use bylaws	2,3,4,5,6,7,8,9
noise disturbances, trespassing, etc.	14
public lake access	9,7,2
reserve areas in subdivisions	2,3,4,5,6,7,8,9
servicing and road maintenance	1,2,3,4,5,6,7
sewage disposal - installation	12,13
sewage disposal - faulty systems	12
shoreline alteration	2,3,4,5,6,7,8,17,19,22
subdivision/development requests	8,9
violation of boating restrictions	14
well construction	12
Wabamun Lake Management Plan	9
Wabamun Provincial Park information	26
water well dewatering	27

Contact Agencies

1. Administrator
County of Parkland
Bag 250
Stony Plain
963-2231

2. Secretary
Village of Wabamun
Box 240
Wabamun
892-2699

3. Municipal Administrator
S.V. of Kapasiwin Beach
8919 - 120 Street
Edmonton
484-3666

4. Municipal Administrator
S.V. of Betula Beach
K-7 Garden Grove Village
Edmonton
434-9975

5. Municipal Administrator
S.V. of Lakeview
K-7 Garden Grove
Edmonton
434-9975

6. Municipal Administrator
S.V. of Pt. Alison
11708 - 83 Avenue
Edmonton
433-5664

7. Municipal Administrator
S.V. of Seba Beach
Box 124
Seba Beach
797-3863

8. Director of Planning
County of Parkland
Bag 250
Stony Plain
963-2231

9. Yellowhead Regional Planning Commission
Box 245
Onoway
967-2249

10. District Agriculturalist
Alberta Agriculture
Box 510
Stony Plain
963-6101

11. Resource Management Section
Archaeological Survey
Alberta Culture
8820 - 112 Street
Edmonton
427-2355

12. Public Health Inspector
Parkland Health Unit
Box 210
Stony Plain
963-2206

13. Provincial Plumbing Inspector
Plumbing Inspection Branch
Alberta Labour
10808 - 99 Avenue
Edmonton
427-3669

14. Royal Canadian Mounted Police
4709 - 44 Avenue
Stony Plain
963-2217

15. Fish and Wildlife Officer
Alberta Energy and Natural Resources
Box 727, Provincial Building
Stony Plain
963-6131

16. Regional Wildlife Biologist or
    Regional Fisheries Biologist
    Fish and Wildlife Division
    Alberta Energy and Natural
    Resources
    10363 - 108 Street
    Edmonton
    427-3574

17. Land Management and Development
    Branch
    Public Lands Division
    Alberta Energy and Natural
    Resources
    9915 - 108 Street
    Edmonton
    427-5209

18. Water Quality Control Branch
    Pollution Control Division
    Alberta Environment
    9820 - 106 Street
    Edmonton
    427-5828

19. Surface Water Rights Branch
    Water Resources Administration
    Division
    Alberta Environment
    9820 - 106 Street
    Edmonton, Alberta
    427-6111

20. Controller of Water Resources
    Water Resources Administration
    Division
    Alberta Environment
    9820 - 106 Street
    Edmonton
    427-6244

21. Water Resources Regional
    Administrator
    15th Floor, Standard Life Centre
    10405 Jasper Avenue
    Edmonton
    427-5296

22. Fisheries Habitat Biologist
    Fish and Wildlife Division
    Alberta Energy and Natural
    Resources
    9920 - 108 Street
    Edmonton
    427-9506

23. Plant Manager
    TransAlta Utilities
    Box 120
    Wabamun
    892-2280

24. Canadian Coast Guard
    Western Region
    Box 10060
    700 West Georgia Street
    Vancouver
    V7Y 1E1

25. Energy Resources Conservation
    Board
    640 - 5th Avenue S.W.
    Calgary
    T2P 3G4

26. Alberta Recreation and Parks
    Standard Life Centre
    10405 Jasper Avenue
    Edmonton
    427-7336

27. Alberta Environment
    Groundwater Branch
    Standard Life Centre
    10405 Jasper Avenue
    Edmonton
    427-6188

APPENDIX 6

NEWSLETTERS

wabamun advisor

May, 1981 Issue Number One

PUBLIC ADVISORY COMMITTEE SET UP

Located just a short drive from Alberta's booming capital, Lake Wabamun over the years has become one of the most utilized lakes in the province.

But as utilization has increased, so has user concern about the lake's weed growth and water quality. Groups of concerned lake users have approached government and industry in an effort to find some solution to the problem.

In response to mounting public concern expressed by the Lake Wabamun Preservation Association, Alberta Environment Minister Jack Cookson in late 1979 launched a two-year study to identify nutrient sources promoting weed growth in the lake. In addition, the minister earlier this year established a 15-member public advisory committee to examine future land and water management practices to help maintain or improve lake quality.

As well as reviewing studies already done on the lake, the Lake Wabamun Watershed Advisory Committee is also holding a series of public meetings in the area this summer to gather local input. A final report with its findings is expected to be presented by the committee to Mr. Cookson by March 31, 1982.

GET TO KNOW YOUR COMMITTEE

Chaired by Charles Weir of Edmonton, the committee — representing a wide range of government, industry and other interest groups — wants to hear from you, the lake users. How? By attending the public meetings when they are announced, making written submissions, oral presentations or just contacting committee members directly. A list of committee members, addresses and telephone numbers can be obtained from the committee's technical assistant Helen Habgood at 427-3943.

COMING UP

More details on the advisory committee's public meetings, Alberta Environment's interim report, making submissions to the advisory committee and updated information materials will be included in future issues of the Wabamun Advisor.

Interested in making a presentation to the committee? Need additional copies of this newsletter? Please Contact:

WABAMUN ADVISOR
c/o LAKE WABAMUN WATERSHED
ADVISORY COMMITTEE
HELEN HABGOOD
ALBERTA ENVIRONMENT
15th Floor, OXBRIDGE PLACE,
EDMONTON, Alberta
TELEPHONE: 427-3943

EUTROPHICATION STUDY CONTINUES

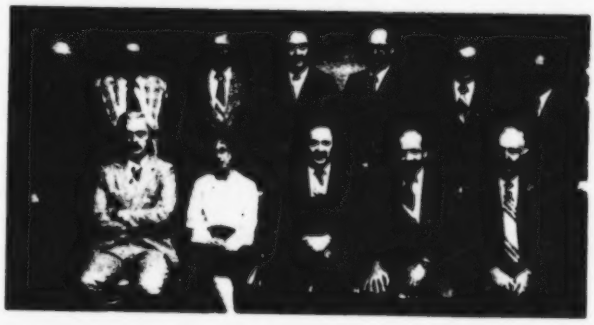
Alberta Environment's two-year study to determine the sources and quantities of nutrients entering Lake Wabamun continues this summer. The study, also assessing the lake's current nutrient level, will attempt to determine if weed growth can be controlled to maintain or improve the lake's quality. An interim report on the study's progress, to be reviewed by the advisory committee, will soon be released.

Lake users can assist in the project by allowing study team members to cross their properties, watching out for equipment or buoys installed in the lake and generally sharing their knowledge of the area with study team members.

INFORMATION TRAILER OPENS

An Alberta Environment Information Trailer —featuring a display on Lake Wabamun's ecology and history — is expected to open the May long weekend in Wabamun. Trailer staff will be on hand to discuss the current lake eutrophication study and any other concerns visitors might have.

MEET YOUR COMMITTEE



Committee members include from left: (Sitting) Fred Williamson, alternate for John Railton, Calgary Power Ltd.; Helen Habgood, Alberta Environment, technical assistant to the committee; Charlie Weir, chairman; Bill Gowan-Smith, Alberta Summer Villages Association; George Mann, County of Parkland. (Standing) Don Stadnick, Village of Wabamun; Roy Bamber, farming community; Norm Giffen, Edmonton Regional Planning Commission; Brian Hammond, Alberta Environment; Bill Davies, Wabamun Home Owners Association; Ken Zelt, alternate for Martin Paetz, Alberta Energy and Natural Resources; Rocky Forest, alternate for George Field, Lake Wabamun Preservation Association. Missing are John Hill and Bob Hurlburt, Lake Wabamun Preservation Association; Miles House, Paul Indian Band; and Paul Skydt, Alberta Recreation and Parks.

wabamun advisor

June 1981 No. 2

LAKE HISTORY, ECOLOGY EXPLAINED

Although the water in Lake Wabamun is no more than 38 feet (11.6 metres) deep, bottom sediments are up to 65 feet (19.8 metres) thick and date back some 9,000 years to the lake's origins at the end of the Ice Age.

Sediments contain a wealth of information about a lake's origins and history and help biologists to better understand a lake's condition today.

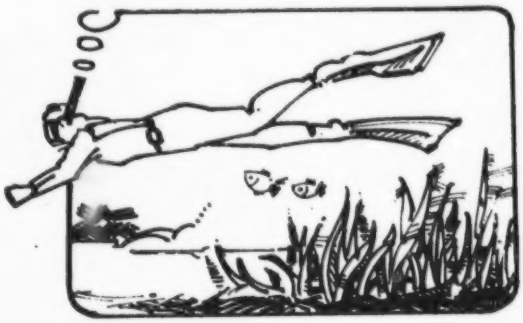
Lake Wabamun Watershed Advisory Committee members are learning these and other details about the lake from presentations made by experts at monthly meetings.

Representing a wide range of government, industry and other interest groups, the public advisory committee is examining future land and water management practices to help maintain or improve lake quality.

'MODERATELY EUTROPHIC'

Lake Wabamun is moderately eutrophic, or fertile, and probably has been for most of its history, University of Alberta biologists Dr. Paul Gorham and Dr. Dale Allen told a committee meeting.

They explained the lake's origins and the role of its sediments (bottom mud) in nutrient cycling and weed growth. Sediments "mop-up" and store plant nutrients, supply nutrients to rooted plants and, under certain conditions, can release nutrients back into the water.



"BOOM AND BUST" WEED

The noxious weed 'Elodea' first appeared in Lake Wabamun in 1968, spreading rapidly and becoming a nuisance to boaters, swimmers and water skiers by the early 1970's. Then, without apparent explanation, most Elodea weed beds decreased dramatically by the mid-1970's.

Janice Crosby, who studied Elodea's "boom and bust" cycle at the lake as part of a larger weed growth study by Beak Consultants for Calgary Power, told committee members Lake Wabamun's Elodea problem appears to be over and is unlikely to recur.

The best theory so far about the weed's cycle in Lake Wabamun is that it virtually killed itself off by depleting iron - an essential element for growth - from lake sediments.

PHOSPHORUS: MAJOR LAKE NUTRIENT

Phosphorus is probably the most important nutrient in Lake Wabamun because its availability helps to determine the extent of weed growth. It can enter the lake from such sources as runoff water from nearby land, groundwater, sewage seepage, precipitation and lake bottom sediments.

Alberta Environment's Lake Wabamun Eutrophication Study is identifying all nutrient sources promoting weed growth to determine if the problem can be controlled.

WEED CONTROLS - OFTEN IMPRACTICAL

There are numerous ways lake weed problems might be controlled, Trefor Reynoldson, a lake biologist with Alberta Environment, told the committee.

Two possible solutions are dredging the whole lake to remove nutrient-rich sediments and flushing out the lake by diverting river water.

But both solutions would be costly and highly impractical, he said. Disposal of dredge spoils would be a major problem; flushing would require a huge pipeline and wouldn't necessarily result in nutrient reduction.

LAKE MANAGEMENT PLAN

The public advisory committee has agreed to assist the Edmonton Regional Planning Commission in developing a Lake Wabamun Management Plan. Not necessarily aimed at restricting growth, the plan would project future land use to achieve the most benefits.

GET IN TOUCH

Committee members want to hear from you. They'll be glad to listen to presentations from any concerned citizen or lake user. Also, be sure to visit the Information Trailer in Wabamun and learn more about the lake study. The trailer is open weekends and statutory holidays.

For more information or additional copies of this newsletter contact:

LAKE WABAMUN WATERSHED ADVISORY COMMITTEE
c/o Helen Habgood
15th Floor, 9820 - 106 St.
Edmonton, Alberta T5K 2J6
Phone: 427-3943

wabamun advisor

July 1981 No. 3

KEEPING BUSY

Lake Wabamun Watershed Advisory Committee members have been keeping busy reviewing studies and reports and listening to presentations at their monthly meetings.

The committee, representing a wide range of government, industry and other interest groups, is examining future land and water management practices to help maintain or improve lake quality.

It has recommended to Alberta Environment Minister J. W. (Jack) Cookson that two proposed management plans for the lake Wabamun area should proceed and be prepared simultaneously.

MANAGEMENT PLANS

An End Land Use Plan will be prepared by the County of Parkland dealing with mine permit areas while the Edmonton Regional Planning Commission (ERPC) is working on developing a Lake Wabamun Management Plan for future land development in the area.

The committee has recommended the ERPC be allowed to see the Management Plan through to completion although the Wabamun area will be excluded from its jurisdiction after 1982.

CONCERNS IDENTIFIED

Committee members have now had an opportunity to discuss lake problems as seen by each of them. As a result, the following list of concerns has been developed:

1. Weed Growth - This includes nuisance weeds and other underwater growth in the lake and the measures (mechanical, chemical, biological) that can be used to control such growth.

2. Water Quality - The effect of nutrients from domestic, industrial, agricultural and other sources, as well as thermal input on water quality. What is the natural condition of the lake?

3. Lake Levels - Both high and low levels have related problems.

4. Land Use Practices and Planning - There is a need for integrated planning and development and increased public awareness. There is also concern about mining operations.

5. Recreation - Public recreation facility areas are insufficient. Boat regulation is also a concern.

6. Fish and Wildlife - Concerns are for management and protection of sport and commercial fishing and protection of wildlife habitat.

7. Other Concerns - These include acid rain, air quality, the effect of alternative cooling facilities, energy costs and the ramifications of committee actions for other Alberta lakes.

What do you think? Which of these are important to you? Let your committee know. Have we missed something?

PUBLIC CONCERNS VOICED

Bill Drager, A Wabamun area cottage owner since 1957, addressed the committee's June meeting to express his concerns about the high water level and beaver dams blocking the lake's outlet stream. Many thanks to Mr. Drager! The committee welcomes public input.

ERCB DECISION

The committee commended the Energy Resources Conservation Board's recent decision which found alternative cooling facilities for the Wabamun power plant were unwarranted. The ERCB instead called for the expansion of weed harvesting in the lake's east end by Trans Alta Utilities (formerly Calgary Power Ltd.).

PUBLIC MEETING PLANNED

An informational public meeting is scheduled for Saturday, September 19 in the Wabamun Hall, 2 to 5 p.m. We want you - the lake user - to have a say in the lake's future.

EXPERIMENTAL ENCLOSURES

Wondering what those four enclosures off Fallis (Coal) Point are? These are experimental areas which will help provide new insight into lake functioning for the Lake Wabamun Eutrophication Study.

Each eight-metre diameter "Limnocorral" extends to the lake bottom, enclosing a mini-lake. Two enclosures will have nutrients added to them to determine the effect increased fertilization will have on the lake. One will be left alone to simulate a reduction in external nutrient supplies. The other will be stirred periodically to determine the effect of water being mixed by wind or boats. The enclosures will remain in the lake until freeze-up, then re-installed next spring to continue the study.

Help the study by staying out of the area and warning off people seen tampering with equipment. Visit the Information Trailer in Wabamun on weekends to see and learn more about the enclosures and the study.

GET IN TOUCH!

If you have any concerns about the lake, don't hesitate. Get in touch with your committee today.

For more information contact:

Helen Habgood
Lake Wabamun Watershed Advisory Committee
2nd floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta T5K 2J6
427-5868

wabamun advisor

August 1981 No. 4

PUBLIC MEETING PLANNED

Concerned about weed growth in Lake Wabamun and the lake's future? Be sure to attend the public meeting this September sponsored by the Lake Wabamun Watershed Advisory Committee. Time and place:

WABAMUN - Saturday, September 19, 1981
2:00 - 5:00 p.m.
Wabamun Hall
Wabamun, Alberta

The 15-member public advisory committee - representing a wide range of government, industry and other interest groups - wants to hear from you, the lake users.

Examining ways to help maintain or improve lake quality, the committee - established in early 1981 - is expected to submit its findings to Alberta Environment Minister Jack Cookson by March 31, 1982.

For more information on the upcoming public meeting; or if you wish to submit or make a presentation, contact Helen Habgood at 427-5868 or 427-7889.

SEWAGE DUMPING STIRS COMPLAINTS

Alberta Environment's Water Quality Control Branch has received complaints from cottagers at Seba Beach and Sunshine Bay concerning the disposal of sewage from sailing craft directly into the lake.

Section 34-13-2 under the Provincial Board of Health Regulations respecting nuisances and general sanitation, reads:

> "No person shall deposit any dead animal, manure excreta, refuse, garbage, liquid waste or other filth upon, or into: any river, stream, lake or other surface water in such a manner that it will or may create a nuisance."

Boat owners should be aware that sewage dumping not only threatens public health, but also contributes nutrients which may worsen algae and weed problems, especially in localized areas near shore. Protection of Lake Wabamun is up to you - the boat owners and cottagers using it.

SAILING CLUB HEARS PRESENTATION

About 50 people attended a Wabamun Sailing Club meeting July 22 where several Lake Wabamun Watershed Advisory Committee members made a presentation on the committee's activities. Shown was the slide/tape audio-visual Preserving Alberta Lakes, produced by Alberta Environment's Water Quality Branch. The committee thanks all who attended for their interest.

EUTROPHICATION STUDY 1981 UPDATE

A new brochure, Lake Wabamun Eutrophication Study: 1981 Update, is available to the public, summarizing interim results of the two-year lake study which got under way in 1980. The study is trying to determine the sources and quantities of nutrients entering Lake Wabamun to learn if lake quality can be preserved through control of nutrient supplies. Copies can be obtained from Pat Mitchell of Alberta Environment at 427-5828 or the department's Communications Branch at 427-6267.

For more information or additional copies of this newsletter contact:

LAKE WABAMUN WATERSHED ADVISORY COMMITTEE
c/o Helen Habgood
2nd Floor, 9820 - 106 Street
Edmonton, Alberta T5K 2J6
Phone: 427-5868 or 427-7889

wabamun advisor

October 1981 No. 5

PUBLIC MEETING A SUCCESS

Some 60 people turned out to voice their concerns about the lake at a public meeting in Wabamun, Sept. 19, sponsored by the Lake Wabamun Watershed Advisory Committee.

Weed growth, water pollution from sewage, and the high water level at the lake and resulting property damage, were the major concerns expressed.

WEED GROWTH

The weeds keep growing in Lake Wabamun. Weed growth this year was reported especially bad at the west end of the lake. Cottagers from the Seba area of the lake told the public meeting they could not recall another year with so much weed growth.

SEWAGE POLLUTION

One major concern voiced at the meeting dealt with sewage pollution - both from leaky septic fields and from large boats.

All lake users - boaters and cottagers alike - should be aware that sewage entering a lake not only contributes to nutrient enrichment and weed growth, but is also a health hazard, especially in localized areas along shore. Cottagers should be particularily careful their septic systems are working properly.

HIGH WATER LEVEL

Lake Wabamun's water level is high despite low rainfall this past summer, partially as a result of beaver dams that completely block the outlet creek.

Alberta Energy and Natural Resources' Fish and Wildlife Division, however, has been unable to deal with the problem since all beaver dams involved are on the Paul Band Indian Reserve. The division is currently negotiating with the band for permission to enter the area and deal with the problem.

OTHER CONCERNS

Lack of boating regulations; lack of monitoring and enforcement of regulations, particularily those dealing with sewage disposal; lack of adequate public recreation facilities; acid rain; and littering by ice fishermen in winter, were among other concerns voiced at the meeting.

The committee thanks all those who attended, wrote letters or called to voice opinions and concerns. This information will be used by the committee in formulating its final recommendations to the Minister of Environment on the lake's future. Recommendations are expected by Spring, 1982.

GOING FISHIN'

THIS WINTER?

DON'T LITTER THE ICE

With winter just around the corner, ice fishing enthusiasts will soon be getting their gear in order. Just remember not to leave anything behind on the ice.

Not only will anything left on the ice enter the lake next Spring, contributing to nutrient enrichment and weed growth - but you could be breaking the law. Littering the ice contravenes the provincial Litter Act, Clean Water Act and Board of Health Regulations.

You can help cut down on ice littering by watching out for offenders and reporting any incidents to Alberta Environment officials at 427-5868.

LAKE PLAN DELAYED

As of January, 1982, Lake Wabamun will no longer be under the jurisdiction of the Edmonton Regional Planning Commission (ERPC). As a result, the ERPC will no longer be developing a management plan for the lake.

The proposed lake management plan may be undertaken by the new Yellowhead Regional Planning Commission, under whose jurisdiction Lake Wabamun will fall.

PUBLIC INPUT WELCOMED

The committee always welcomes public input. Remember, this is your lake and you have a say in its future.

For more information or additional copies of this newsletter contact:

LAKE WABAMUN WATERSHED ADVISORY COMMITTEE
c/o Helen Habgood
2nd Floor, 9820 - 106 Street
Edmonton, Alberta T5K 2J6
Phone: 427-5868 or 427-7889

wabamun advisor

February 1982 No. 6

INTERIM REPORT SUBMITTED

Lake Wabamun Watershed Advisory Committee members this past December submitted an interim report to Environment Minister Jack Cookson with findings and recommendations to date.

The 15-member committee, made up of representatives from citizen groups, industry and government, was established a year ago by the minister to examine future land and water management practices at the lake.

In the interim report, the committee addresses a number of areas of concern identified so far by its members with input from lake users. Recommendations are made for the following problem areas:

CONCERNS ADDRESSED:

SEWAGE DISPOSAL FACILITIES FOR BOATS

A number of complaints about large boats disposing of sewage directly into the lake, were received by the committee during the past summer. The issue was also raised at a public meeting sponsored by the committee this past September in Wabamun.

Water Quality

Lack of on-shore, publicly available septic holding tanks for sewage disposal convenient for use by boaters, is part of the problem.

To resolve the situation, the committee recommends:

(i) That marinas, yacht clubs and lakeshore trailer parks be required to provide septic holding tanks for boaters, campers and motorists to discard sewage.

(ii) Installation of septic holding tanks for use by boaters and the general public at Seba Beach.

SEPTIC TANK PUMP-OUT TRUCKS

Public Health

Concerns were expressed over the improper dumping of cottage sewage by pump-out trucks in such places as sanitary landfills, roadside ditches and private land.

The problem will be alleviated with the establishment of a sewage lagoon at Seba Beach where pump-out trucks can easily dump their loads.

To further reduce public health and sanitation concerns, the committee recommends:

(i) That sewage pump-out trucks be licensed with the provincial Board of Health and/or the county.

(ii) Stricter enforcement of regulations concerning septic tank sewage disposal.

BEAVER CONTROL

Lake Level

Beaver dams blocking the outlet creek from the lake were partly responsible for the high water level this past summer. Many complaints were received about the problem.

Alberta Energy and Natural Resources' fish and wildlife division, responsible for beaver control, has been unable to deal with the situation because all the dams involved are on the Paul Band Indian Reserve. Negotiations are currently under way to enter the area and deal with the problem.

The committee strongly urges the Environment minister to work with the two parties in reaching an early agreement in order to unblock the creek and keep it flowing free.

EXTENTION OF THE COMMITTEE

To benefit from the findings of the lake eutrophication study under way by Alberta Environment; the on-going end land use plan being prepared jointly by the county and Trans Alta Utilities; and the proposed lake management plan expected to be developed during the next two years, an extention is being requested.

The committee has asked the Environment minister to extend its tenure to Dec. 31, 1983, for submission of a final report and recommendations. Members had been expected to submit their final report to the minister by March 31 of this year.

NEW PIER FOR WABAMUN

In other news, the federal Department of Fisheries and Oceans has given preliminary approval to replace Wabamun wharf. The new pier will include a launch ramp capable of accommodating fixed-keel vessels. Work on the project is expected to get under way this year. Any interest and/or concerns regarding the new pier should be directed to the committee.

INTERIM REPORT AVAILABLE

You can obtain a copy of the committee's interim report by contacting the address listed below.

The committee welcomes your comments, concerns and suggestions.

LAKE WABAMUN WATERSHED ADVISORY COMMITTEE
c/o Helen Habgood
2nd Floor, 9820 - 106 Street
Edmonton, Alberta T5K 2J6
Phone: 427-5868

wabamun advisor

July, 1982 Vol. 2 No. 1

COMMITTEE EXTENSION

Lake Wabamun Watershed Advisory Committee members will be working together for another year. Alberta Environment Minister Jack Cookson has extended the committee's tenure from March 31, 1982, to Dec. 31, 1983.

Earlier this year, the committee requested its tenure be extended to benefit from the findings of the Lake Wabamun Eutrophication Study, under way by Alberta Environment, and the End Land Use Plan, being prepared jointly by the county and TransAlta Utilities. The extension will also allow the committee to participate in the development of a Lake Management Plan, currently under way by Alberta Municipal Affairs.

'THANKS' HELEN

Helen Habgood, who acted as technical assistant to the committee since its inception, has left to take a new position with a Vancouver-based consulting company. She will be involved in a wildlife habitat study in northwestern British Columbia.

The committee would like to take this opportunity to publicly thank Helen for her many contributions.

CONSULTANT APPOINTED

Dr. Dale Allen, a research associate with the University of Alberta's botany department, has been appointed as a consultant to the committee. Dr. Allen will be reviewing and commenting on scientific documents for the committee. He will also advise committee members on various weed control programs.

PUBLIC MEETINGS PLANNED

Still wondering about weed growth in Lake Wabamun and the lake's future?

Area residents will get another chance to express their concerns at a public meeting tentatively scheduled by the committee for Aug. 28, 1982. Weed growth, water pollution from sewage, the lake's high water level and resulting property damage, were major concerns expressed at last September's public meeting.

These and other concerns were taken into consideration by the committee in preparing its interim report, submitted to the Environment minister last December. The report contains first-year findings and recommendations on future land and water management practices to help maintain or improve lake quality. A summary of the recommendations was published in the last issue of this newsletter (Feb. 82).

LAKE MANAGEMENT PLAN

The Lake Management Plan Advisory Committee for Lake Wabamun will also participate in the upcoming public meetings. The plan is currently under development by Alberta Municipal Affairs. Charles Weir has replaced Helen Habgood as the Lake Wabamun Watershed Advisory Committee representative on the Lake Management Plan Advisory Committee.

NEW MEMBER

Allan McTavish was appointed by ministerial order, April 19, 1982, as a committee member representing the Lake Wabamun Preservation Association. He replaces George Field.

EUTROPHICATION STUDY

Alberta Environment's two-year-old study to determine the sources and quantities of nutrients entering Lake Wabamun, continues this summer. The study, also assessing the lake's current nutrient level, will attempt to determine if nutrients can be controlled to maintain or improve lake quality.

An interim report on the study's first-year findings was released by Alberta Environment last fall. Copies are available from the department's Water Quality Control Branch (Patricia Mitchell) at 427-5828.

SEPTIC "SNOOPER"

As part of the eutrophication study, Alberta Environment will be using a special monitoring instrument called a septic "snooper" this summer to enhance its findings. The instrument detects effluent from cottage fields seeping into the lake. Study team members will boat along the lakeshore some time in mid-summer taking water samples, says study team head Patricia Mitchell.

EXPERIMENTAL ENCLOSURES

The four experimental areas off Fallis (Coal) Point, used by the study team last year, will again be in operation this summer.

Each eight-metre diameter "Limnocorral" extends to the lake bottom, enclosing a mini-lake. These are used as test areas for studying lake nutrient levels. This summer, the study team will concentrate on investigating the quantity of nutrients being recycled from the bottom sediments.

You can help the study by staying out of the area and warning off people seen tampering with equipment.

INFORMATION TRAILER GONE

To learn more about the study, an Information Trailer was set up at Wabamun on weekends during the past two summers. With study-end nearing, however, this information centre has now been phased out.

But information on the study and the lake, including brochures and copies of the study's interim report, are available by contacting: Patricia Mitchell, Water Quality Control Branch, Alberta Environment, Edmonton (427-5828).

KEEP IN TOUCH!

If you have any concerns about the lake, don't hesitate. Get in touch with your committee today.

For more information or additional copies of this newsletter contact:

LAKE WABAMUN WATERSHED ADVISORY COMMITTEE

C.H. Weir, Chairman 11405 - 163 Street Edmonton, Alberta	OR	Bill Diepeveen Public Participation Alberta Environment 11th Floor, 9820 - 106 St. Edmonton, Alberta PHONE: 427-6338

wabamun advisor

December, 1982 Vol. 2 No. 2

PUBLIC MEETING

High water levels and weed growth were major concerns expressed by area residents during a public meeting this past summer in Wabamun sponsored by the Lake Wabamun Watershed Advisory Committee.

Dr. Dale Allen, a consultant with the committee, reported weeds were generally lower this year as a result of the cold winter, late spring and high water levels.

Of greater concern to many lake residents was this year's high water level which caused erosion and other flood-related damage to a large number of lake frontage properties. Public meeting participants passed a unanimous motion that the advisory committee establish the 1976 level of about 724.40 metres (GSC) as the norm for Lake Wabamun and that some means of control be established to protect that level. The water level at the lake this year reached 725.12 metres (GSC).

SPECIAL COMMITTEE

In response to high water concerns raised by residents, a committee chaired by Park Powell, Water Resources Administration Division, Alberta Environment, has been established to study outlet control methods and to identify long-term lake level objectives.

The committee, made up of representatives from the various summer villages around Lake Wabamun, County of Parkland, Paul Band, TransAlta Utilities and the advisory committee, hopes to have a water balance model ready by next April. The new committee will be utilizing data collected by the Lake Wabamun Eutrophication Study in examining how various water levels affect the lake.

SECOND INTERIM REPORT SUBMITTED

A Second Interim Report on its findings to date, was submitted by the advisory committee to the Minister of Environment, Sept. 16. In the report, the committee addresses both weed growth and high water concerns. Following is a summary of its conclusions:

WATER LEVELS

With the high water levels and reduced weed growth reported in 1982, many lake users are asking that action be taken to alleviate flooding and erosion. To resolve the problem, the committee recommends that Alberta Environment develop a program for improving, repairing and/or replacing the existing outlet control structure and outlet channel to stablize the water level of Lake Wabamun.

WEED AUTHORITY?

The establishment of a weed harvesting program, carried out by an independent weed control authority, is being studied by the committee. As a lake user, you can take part in the study by responding to the attached questionnaire.

WEED GROWTH

In 1982, the committee dealt with several proposed solutions to reduce weed growth and improve lake quality. These include:

Flushing and Dilution: The committee concluded either of these measures would be impractical. Flushing out the lake with large amounts of water would be impossible because neither the North Saskatchewan nor the the Pembina rivers have outflows capable of producing the flushing action required. Dilution, using water from the same rivers to increase the amount of clean water entering the lake, would also be difficult and not necessarily improve water quality because of the high nutrient level of the Pembina.

Dredging of Lake Sediments: The committee concluded that dredging of the whole lake is impractical and not a workable solution for water quality improvement because of the possible damaging effects it would have on underwater life and lake bottom sediments.

Lake Bottom Treatments: The committee recommends the treatment of selected locations using (i) fibreglas screens and/or plastic linings to reduce weed problems around private and public docks, piers and swimming areas (ii) sand in certain areas to enhance recreational beaches and discourage weed growth. The committee does not recommend the use of flyash as a bottom sealant because of its heavy metal content and other potential problems.

Herbicide Use: The committee recommends the Environment department embark on a program to implement the use of herbicides on a very limited scale in localized areas of Lake Wabamun. Such a program would be carefully monitored to determine the effect on undesirable weed growth. Large-scale herbicide application is not recommended for the lake due to the exposure risk to the public and unknown ecological effects.

EUTROPHICATION STUDY

The field work phase of Alberta Environment's two-year study to determine the sources and quantities of nutrients entering Lake Wabamun, is now complete. Department staff, however, will continue to collect precipitation at various sites around the lake throughout the winter.

A technical report and separate informational publications on various aspects of the study, will be prepared by the study team. An initial summary of data will be forwarded to the advisory committee to assist it in making recommendations on the lake's future.

For more information on the study, contact Patricia Mitchell, Water Quality Control Branch, Alberta Environment, at 427-5828.

ASK US!

If you have any concerns about the lake, don't hesitate. Get in touch with your committee today. Copies of the advisory committee's Second Interim Report are also available. To have your name added to the distribution list for this newsletter, contact Bill Diepeveen below.

LAKE WABAMUN WATESHED ADVISORY COMMITTEE

C.H. Weir, Chairman 11405 - 163 Street Edmonton, Alberta	OR	Bill Diepeveen Public Participation Alberta Environment 11th Flr., 9820 - 106 St. Edmonton, Alberta PHONE: 427-6338

wabamun advisor

June, 1983 Vol. 3 No. 1

FINAL RECOMMENDATIONS

After almost three years of research, the Lake Wabamun Watershed Advisory Committee is now in the process of preparing its final recommendations. Considerable work has been done to date and members are confident the final report will provide an excellent overview of general lake improvement techniques, including those particularly suited to Lake Wabamun.

REVIEW COMPLETE

One of the first steps taken by the committee was to commission Helen Habgood, former technical assistant, to undertake a comprehensive literature review dealing with Lake Wabamun. The review is now complete and a limited number are available for public distribution. For easy public access, copies of the 'Lake Wabamun Literature Review' have been sent to the library in Wabamun, Seba Beach, Stony Plain, Spruce Grove, the Centennial Library in Edmonton and the University of Alberta library.

DISPLAY BOOTH

The committee took part in the recent Edmonton Sportsman Show with a display booth providing information on the lake. More than 350 people stopped to chat with committee members and Alberta Environment staff involved in the eutrophication study at the lake. The experience allowed for a direct exchange of ideas between committee members and lake users.

ENVIRONMENT WEEK

The committee will be among groups setting up displays at Heritage Mall in Edmonton during Environment Week, June 5 - 12. This will give the general public another opportunity to meet with committee members at a time when the committee will be finalizing its report to the Minister of Environment.

LAKE LEVEL COMMITTEE

The Wabamun Lake Level Advisory Committee, a separate committee established by Alberta Environment last year to study outlet control methods and identify long-term lake level objectives, is now awaiting completion of a water balance model for the lake. This model will provide a picture of how much water enters the lake and where it originates.

It will also provide an analysis of the various ways water leaves the lake, including outflow via groundwater, Wabamun Creek, evaporation etc. All this information is necessary before any decisions can be made on how to effectively control lake levels.

EUTROPHICATION STUDY

Sampling for the Lake Wabamun Eutrophication Study was completed in the fall of 1982. Data analysis is still under way, but study results show most nutrients entering the lake come from the surrounding watershed, carried by streams draining into the lake. Cleared agricultural or disturbed land contributed larger quantities of nutrients than forest or bush land. Cottage septic systems are a very minor source of nutrients to the lake.

Because much of the nutrient supply to the lake is natural (about 50 per cent from rainfall, forested areas and groundwater), major nutrient control projects are not warranted. However, for long-term maintenance of water quality, everyone located on the lake shore or within its watershed should implement their own nutrient control program. Some suggestions include:

* Leave as much natural vegetation as possible on the land, especially on land near the water's edge or along streams.

* Minimize fertilization of gardens or lawns near the lake shore.
* Inspect cottage septic systems and upgrade if faulty.
* Do not import soil or sand to replace eroded property to improve beaches; this material often contributes to local weed growth.
* Control erosion on any construction within the watershed, including roads or cottages.

The final study report will be made public in a series of three brochures. The first is expected to be released in mid-summer and will report findings on sources and quantities of nutrients measured during the three-year study.

QUESTIONNAIRE RESULTS

The committee has been studying the possible establishment of an independent weed harvesting authority at the lake. Lake users were asked to participate in the study by responding to questionnaires circulated with the last issue of this newsletter (Dec. 82). A total of 137 responses were received from area cottages, sailing/yacht clubs, summer villages/county and general lake users.

A large majority found the existing weed harvesting program inadequate and indicated an expanded program is required. The largest group of respondents (53 per cent) indicated swimming is affected by weed growth. On the question of financing, both cottagers and summer villages (with the exception of Betula Beach) were opposed to paying any portion of weed harvesting costs. The sailing/yacht clubs were generally in favor of paying, while there was a 49 - 51 split against paying among general lake users.

While a majority of cottagers directly affected by weed growth indicated a willingness to assume a portion of the cost of an expanded program, the overall trend was against payment.

LAKE MANAGEMENT PLAN

The Yellowhead Regional Planning Commission has completed Phase One of the Wabamun Lake Management Plan, which primarily involved the gathering of baseline data. The committee assisted in development of the plan through Phase One.

A request has been forwarded to the Alberta Planning Board by the planning commission for sufficient funds to carry out Phase Two. This phase will involve the actual development of the plan, including a land use plan and water surface zoning. An extensive public involvement program is anticipated. The committee encourages lake users and other concerned groups to become involved in the planning process through the public involvement program.

MORE INFORMATION

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APPENDIX 7

TRANSALTA UTILITIES

LAKE WABAMUN

AQUATIC WEED CONTROL PROGRAM

1982

LAKE WABAMUN 1982 AQUATIC WEED CONTROL PROGRAM

INTRODUCTION

The 1982 aquatic weed control activities in Lake Wabamun consisted of a mechanical harvesting program. Mechanical harvesting operations concentrate on a 366 acre area of Kapasiwin Bay, which is subject to the thermal discharge from the Wabamun Generating Plant. This area was expanded in 1981 from the previous 316 acre grid to include 30 acres off Pt. Alison and 20 acres in the vicinity of the plant inlet canal. One hundred and twenty-four acres of this area required harvesting in 1982. The weed boom, which is normally placed at the East end of the bay off Kapasiwin Beach, was not installed in 1982 at the request of the Village of Kapasiwin.

Letters were sent to representatives of the Villages of Wabamun, Lakeview, Kapasiwin and Pt. Alison informing them of our 1982 Weed Harvesting Program. We indicated that our equipment would be available to assist them if any beach clean-ups were required.

The Lake Wabamun Advisory Committee visited the site August 19, 1982. A tour of the lake was made by helicopter and, later in the day, all committee members had the opportunity to witness the actual operation of a Weed Harvester. A full discussion was held with committee members covering various aspects of the harvesting program.

The Lake Wabamun Advisory Committee also sponsored a public meeting at Wabamun on August 28, at which any questions regarding the Weed Harvesting Program were addressed.

MECHANICAL HARVESTING PROGRAM

The aquatic weed harvesting operation was conducted in the Kapasiwin Bay of Lake Wabamun. A "grid" was laid out, in similar fashion to previous years, consisting of 55 sections each 500 foot square. This grid and 1981 grid expansions are shown in Figure No. 1 and an aerial photograph of the area is shown in Figure No. 2. Company survey crews located and anchored 30 floating buoys throughout the grid, which served to guide the harvesting crews.

The fleet consisted of three harvesters and four transporters although only two harvesters and two transporters were required to keep up with the weed growth in 1982.

The harvesters are capable of cutting submerged weeds at varying depths up to five feet. The water depth throughout the majority of the weed grid is over five feet and, therefore, the weeds are cut off but not entirely removed. The harvested weeds are elevated by a conveyor belt to the "hold" of the harvester where they are accumulated. The hold is actually another conveyor belt. When the hold is full, a transporter couples with the harvester and the weeds are conveyed to the transporter. The harvester

then resumes cutting while the transporter shuttles to the shore unloader and back. At the shore unloader, the weeds are conveyed to a truck for transportation to the ultimate disposal site, a worked out gravel pit on Company property.

MECHANICAL HARVESTING RESULTS

The weed harvest, by section, is laid out in Figure No. 3.

Table No. 1 outlines some parameters of the weed harvesting program as compared to previous years.

As seen in Table No. 1, the magnitude of the weed yield in 1982 was the lowest in the eleven year history of the program. The yield for the first three years of the program were substantially higher than those of any subsequent year.

The weed harvesting operation commenced on July 6, however, was shut down on July 13 due to a lack of weeds. The program re-started on July 26, and continued until harvesting operations were shut down on August 19, again due to lack of weeds.

Grid Areas number 22, 23, 39, 49 and 41 were cut twice, and even in these areas, regrowth was slow. It should be noted that the lake experienced record high water levels during July.

WEED BOOM

The purpose of the weed boom is to prevent uprooted rafts of weeds from being blown on the beach as Kapasiwin. It consists of eight pieces of plastic pipe, hinged together to make four sections. The ends of each section are anchored. The bottom of the pipe is weighted and the top has a 29 inch high mesh attached to prevent floating weeds from washing over the partially submerged pipe. The boom is normally anchored about 1,000 feet off the beach at Kapasiwin (Figure No. 4).

Weed growth for the period 1975-1979 was very much reduced compared to the earlier years of the program, when beach rafting of weeds was a problem. The need for the weed boom was much reduced and therefore it was decided, upon request from the Village of Kapasiwin, to not install the boom in 1980. It was decided in 1981 and again in 1982 not to install the weed boom.

High winds of July 14 did deposit some weeds on beaches of lakefront cottages. Clean up at Kapasiwin Beach took place July 15 and 16.

TABLE I

WEED HARVESTING PROGRAM SUMMARY

PARAMETER	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Weeds harvested in grid* (tons)	1,547	3,599	1,266	333	259	384	672	399	270	167	83
Beach cleanup (tons)	154	1,328	1,004	-	-	-	-	-	-	25	5
Other* (tons)	-	211	6	15	-	-	21	11	12	27	9
Total removed (tons)	1,701	5,138	1,176	348	259	384	707	410	282	219	97
Grid area (acres)	230	316	316	316	316	316	316	316	316	366	366
Area actually harvested (acres)	207	281	184	138	75	161	207	143	92	120	124
Harvest/area harvested (tons/acres)	7.5	12.8	6.9	2.4	3.5	2.4	3.2	2.8	2.9	1.6	.67
Harvest/grid area (tons/acres)	6.7	11.4	4.0	1.1	0.8	1.2	2.1	1.3	.85	.53	.23

Notes:
1. *Expanded in 1981
2. Other in 1982 refers to weeds harvested off Kapasiwin Beach
3. 1982 Beach clean-up tons estimated

COSTS

The costs of the 1982 program are itemized as follows:

Harvesting Operation

1.	Total labour costs	$16,062
2.	Vehicle costs	2,585
3.	Materials	2,875
4.	Miscellaneous	2,060
		$23,582

PROPOSED 1983 PROGRAM

Harvesting operations are again planned for 1983. The need for placement of the weed boom will be examined on a year to year basis.

Representatives of Kapasiwin, Wabamun, Lakeview and Pt. Alison will again be asked for their input regarding the Weed Harvesting Program.

Weed Harvesting Areas Wabamun Plant
expanded grid system

FIGURE NO. 1
scale 1" = 700'

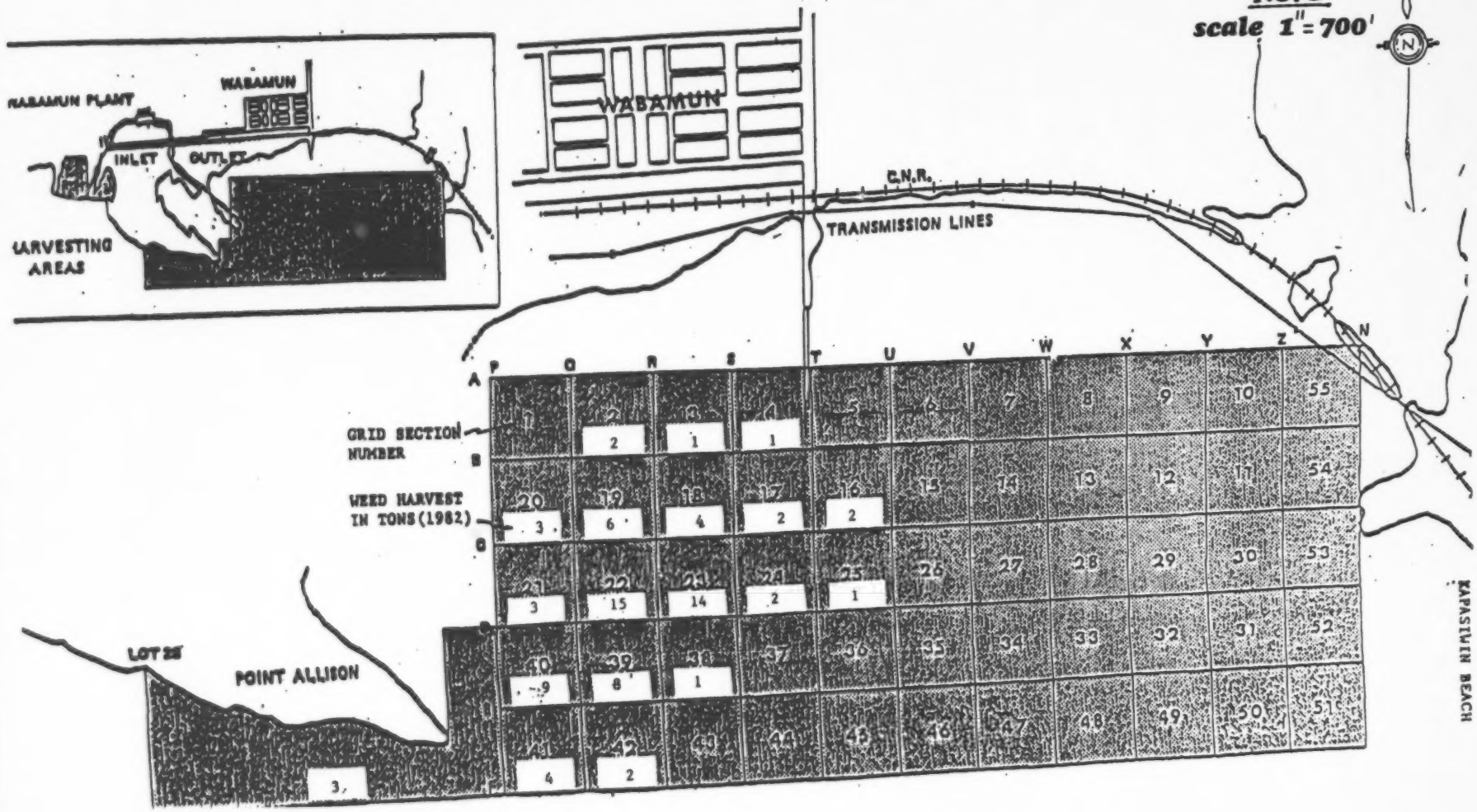

FIGURE NO. 2

KAPASIWIN BAY – PLANT OUTLET CANAL

Date of Photo – August 10, 1982

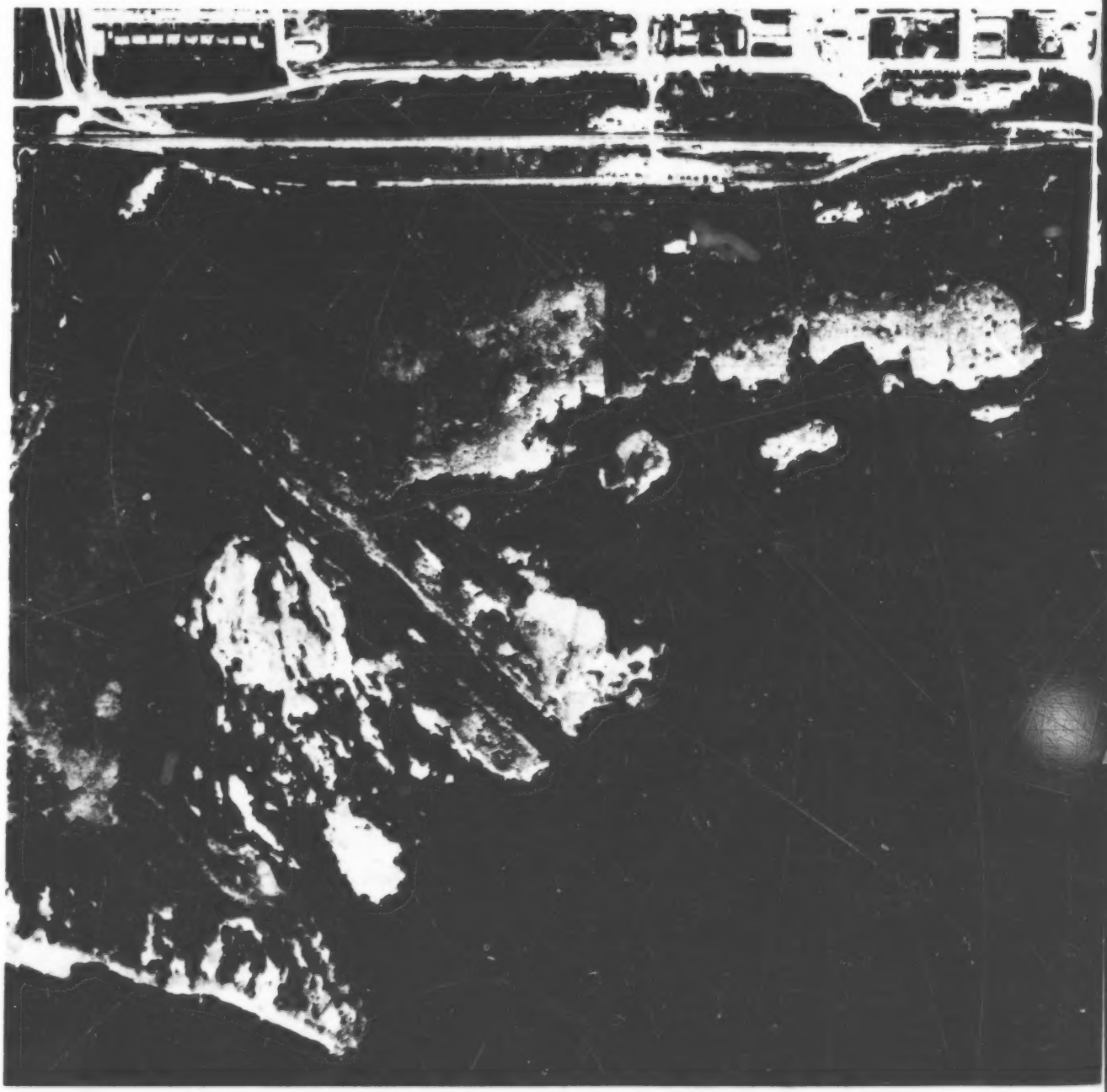

FIGURE NO. 3

1982 WEED HARVEST BY SECTION (IN TONS)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
July and August	-	2	1	1	-	-	-	-	-	-	-	-	-	-	-	2	2	4	6	3

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
July and August	3	15	14	2	1	-	-	-	-	-	-	-	-	-	-	-	-	1

	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	PT. ALLISON**	OTHER*	TOTA
July and August	8	9	4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	3	9	9:

* Other in 1982 refers to Kapasiwin Beach Area
** Pt. Allison totals include those weeds harvested in Inlet Canal Area

503/3B(5)

FIGURE NO. 4

KAPASIWIN BEACH

Date of Photo – August 10, 1982